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JUNE, 1958

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SURVEY OF MOSS DISTRIBUTION IN NEW ZEALAND

WILLIAM MARTIN[1]

The area occupied by any moss (as well as its distribution within that area) is a resultant of many factors, chief of which would appear to be the geologic age and history of the moss; its centre of origin; the availability of suitable habitats; the specific "make up" of the moss; the amount and distribution of the rainfall; the pH, moisture content and other factors of the substratum; the normal average humidity of the air; the absence or presence and duration of intervals of drought; toleration of or adjustment to particular light intensities and temperatures; reaction to altitude; prevalence and character of prevailing winds; biological factors such as absence of spore production, presence of propagula, water storage tissues, etc. As a consequence some mosses are of ancient lineage and cosmopolitan, while others are of strictly local occurrence; some are tolerant of a wide range in the pH of the substratum, in light intensities and other factors, while others are restricted to a narrow range.

In previous papers (1946-52) the writer has given a detailed account of the distribution of each individual species in respect to the 18 botanical districts and subdistricts of the three main islands. It is on these that much of the present summary is based; but when the small size of many species is considered and the sporadic appearance of others, together with the fact that there remain large tracts of mountainous country from which not a single record is available, it will be clear that some modification of the present account is inevitable. The purpose of this essay is to show (1) that Cockayne's Botanical Provinces in New Zealand established for the vascular flora hold good for the moss flora also; (2) that

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each altitudinal change in the vascular flora is accompanied by a simultaneous change in the moss flora; (3) that large elements of the moss flora are restricted to one side or the other of the 125 cm. isohyet; and (4) that the general outline of moss distribution is greatly modified by both ecological and biotic factors.

Elimination of Erroneous and Doubtful Records

Many of the earlier locality records are too vague or too problematical for inclusion in the general scheme: and many species have been eliminated by Sainsbury in his recently published *Handbook* (1956). For the purpose of the present account the writer accepts Sainsbury's delimitation of species and varieties, but retains as valid three species or varieties suppressed by that author (see Martin, 1956). Three supposedly endemic genera—*Blindiopsis*, *Hennediella* and *Sainsburyia*—have had their representative species merged in *Blindia*, *Pottia* and *Tortula*, respectively.

Allowance has had to be made for many erroneous determinations often involving both genus and species. Thus *Barbula rostrata* has proved to be an admixture of an *Orthotrichum* and a *Tortula*, *Camptochaete brachydictya* is just *Neckera laevigata*, *Dicranella egmontensis* is *Dicranum aucklandicum*, *Meteorium nitens* is *Papillaria nitidiuscula* (now known as *P. nitens*), *Macromitrium hectori* is a *Schlotheimia* close to *S. brownii*, and the plants listed as *Taxithelium polystichum* have been mistaken for *Acanthocladium extenuatum*.

In 1881 Armstrong published a catalogue of the mosses indigenous to Canterbury including such improbable species as *Catharomnion ciliatum*, *Ctenidium pubescens*, *Eucamptodon inflatus* and *Macromitrium longirostre* (*typicum*). As these are not represented in his herbarium and have not been recorded by subsequent investigators, they have been rejected. Berggren's record of *Campylopus holomitrium* from Dunedin, on the grounds that elsewhere it is known only from thermal soils in the volcanic area of the North Island, is likewise discarded. It is probable Berggren's plants came from Rotorua and that the labels have been confused. Some two dozen mosses are catalogued by Sainsbury as dubious indigens.

Previously Unrecorded Locality Records

Since the publication of my Supplement No. 2 (1952) several additions to the Sounds-Nelson Botanical District have been discovered in the herbarium of Mrs. E. Amy Hodgson all collected by McMahon. The writer also detected the rare moss *Gigaspermum repens* at Roxburgh in Otago. This moss had not previously

been observed in New Zealand by any living botanist, but had been recorded both from Stewart Island and North Island each from a single locality. Another moss, *Buxbaumia aphylla*, rare in New Zealand and previously detected usually in plantations of exotic trees, was recently discovered by Prof. D. G. Catcheside at Arthurs Pass and by the writer on Mt. Cargill and on Mt. Flagstaff at Dunedin, all three from areas of native vegetation.

Latitudinal Distribution

Cockayne (1928) has divided New Zealand into three Botanical Provinces—Northern, Central, and Southern—and each of these into a number of Botanical Districts. The boundary lines between these three Provinces lie approximately on 38° and 42½° south latitude. These were based solely on the vascular flora, but it can now be stated that they apply equally to the moss flora. Eight northern mosses do not range south of lat. 38°, and 72 of the Central Province do not range north of lat. 38°. Some of the subalpine mosses amongst these are doubtless restricted by the absence of high mountains in the Northern District, but the majority are mosses of the lower levels.

Many mosses of the North Island reach their most southern habitats about lat. 41½° in the South Island and some others about lat. 42½°. In the following list of such mosses those not known south of lat. 41½° are marked with an asterisk: **Braithwaitea sulcata, Catharomnion ciliatum, *Ctenidium pubescens, *Dicnemoloma sieberianum, Dicranoloma obesifolia, *Fissidens muelleri, *F. pallidus, * Funaria gracilis, Homalia auriculata, *Hyophila novae-scelandiae, Leptodontium interruptum, *Papillaria nitens, *Porotrichum oblongifolium, Psilopilum crispulum, *Pterygophyllum distichophylloides, *Rhynchostegiella novae-zealandiae, Tayloria calophylla, Tortella rubripes, Weissia weymouthia*, and **Zygodon obtusifolius*.

Of 35 mosses confined to the Southern Province, fully a score have a very restricted range or are known from but a single area. Only nine mosses occur near the northern boundary of the Southern Province and none of these is wide ranging.

A few moss species belonging to the circumpolar or subantarctic moss flora reach the mainland of New Zealand. Of these *Schlotheimia campbelliana* is not known north of Stewart Island, while *Eriopus apiculatus, Macromitrium longirostre (typicum)*, and *Muellerella crassifolia* are found both in Stewart Island and on the east coast of Otago but not north of Dunedin.

Sixty-nine mosses are restricted to North Island, 64 to South Island, and only one to Stewart Island. Exactly one-half of the

moss flora ranges the full length of the Dominion. Total taxa for the three Botanical Provinces are Northern 369, Central 417 and Southern 392.

Vertical Distribution

No previous review of the vertical zoning of the moss flora has been attempted, and even now no records are available for vast areas of mountain slopes. Sufficient, however, is known to warrant a preliminary review.

The several vertical zones have no fixed altitudinal limits since they are determined partly by latitude and largely by aspect. The western slopes lie more to the sun than do the eastern slopes, while the strength and nature of the prevailing winds, the prevalence or absence of fog and even the rainfall each influence the zonation of the vegetation. The base of the alpine zone is assumed to be the lowest level of the average winter snow line which varies from 1500 to 2500 metres, or even lower in the south. The subalpine zone extends from about 600 metres to the base of the alpine zone, and the montane zone from approximately 300 to 600 metres. The lowest zones are the coastal and the lowland.

The transition from subtropical rain forest to subantarctic rain forest in forested areas is usually quite abrupt and varies from 600 to 650 metres as a rule, but in areas of grassland the ecotones between lowland and montane and between montane and subalpine are rarely so clearly marked. The subalpine belt often comprises a belt of forest fringed on the bush line by a narrow zone of shrubs, with an area of grassland, herbfield, fellfield, talus slope or bare rock separating it from the snowline.

1. Coastal Mosses. The following mosses are strictly coastal in their known occurrences: *Archidium elatum, Aulacopilum glaucum, Aloina sullivaniana, Crossidium geheebii, Eriopus apiculatus, Funaria microstoma, Macromitrium longirostre* (except in Stewart Island), *M. fragile, Muelleriella crassifolia, Pottia maritima, Sematophyllum homomallum, Tortella mooreae, T. rubripes.*

2. Lowland Mosses. Of some 220 mosses occurring in the lowland belt, about 120 are confined to altitudes below 300 metres. A majority of species in the following genera are confined to the lowland belt: *Acaulon, Astomum, Braithwaitea, Catharomnion, Ctenidium, Daltonia, Dawsonia, Fabronia, Funaria, Gigaspermum, Leptodontium, Mittenia, Papillaria, Pleurophascum, Physcomitrium, Pottia, Pseudephemerum, Trematodon, Triquetrella, Wilsoniella.*

3. Montane Mosses. In that transition zone between the lowland and subalpine zones, we meet an admixture of mosses

predominantly lowland or predominantly subalpine, mosses common to all zones from lowland to subalpine and a number of mosses most commonly restricted to the montane region or at least more common there than elsewhere. The following are characteristically montane: *Aulacomnium palustre, Cheilothela chilensis, Cyrtopus setosus* (save in Stewart Island), *Dicranella cardotii, D. gracillima, Ditrichum brevirostrum, D. calcareum, D. elongatum, Encalypta vulgaris, Entodon truncorum, Glyphothecium sciuroides, Goniobryum subbasilare, Grimmia inaequalis, G. laevigata, G. obtusata, Hampeella alaris, Hedwigia ciliata, H. integrifolia, Leptostomum macrocarpum, Leptotheca gaudichaudii, Meesia muelleri, Mielichhoferia eckloni, Pohlia cruda, Pseudodistichium brotherusii, P. buchanani, Psilopilum bellii, Rhizogonium mnioides, Sematophyllum tenuirostre.*

4. SUBALPINE MOSSES. In forested areas, the change from subtropical to subantarctic rainforest is usually quite abrupt. The lowland trees and shrubs give way to such trees as *Nothofagus menziesii, N. cliffortioides, Podocarpus hallii, Griselinia littoralis, Nothopanax colensoi, Pseudopanax lineare, Hoheria glabrata,* and their normal associates. New mosses immediately appear, most abundant and most conspicuous of these being *Dendroligotrichum dendroides*, a tall, dark green moss which remains abundant to the timber line. Indeed, this moss may carpet the forest floor for many square metres at a stretch. Only in Stewart Island and in the sounds area of Western Otago does it invade the lowland forest.

It is in the subalpine forest that the genus *Dicranoloma* reaches its maximum development, often forming a continuous and rather treacherous carpet over the exposed roots of the timber trees. The following are characteristic mosses of subalpine forest though few are wholly confined to this zone: *Atrichum ligulatum, Breutelia elongata, Campylopus arboricola, Dicnemon calycinum, D. semicryptum, Holomitrium perichaetiale, Leptostomum inclinans, Leptotheca gaudichaudii, Lepyrodon australis, L. lagurus, Mesotus celatus, Mniodendron comosum, Hylocomium splendens, Polytrichum formosum.*

The pendulous Weymouthias are often abundant, draping the limbs of forest trees or depending from the branches of the "lacebarks" (*Hoheria*) in the more open glades of the wetter areas, but both species are common members of lowland forests also. Equally common are *Bartramia halleriana, Cladomnion ericoides* and *Ptychomnion aciculare.* In all, some 40 species are common in subalpine forest and approximately 30 occupy the corresponding zone in grasslands and herbfields as well as more elevated areas.

The shrub zone fringing many of the forests in areas of high rainfall or persistent fogs is the headquarters of the Orthotrichaceae in New Zealand. Here we meet most species of *Ulota* and the endemic genus *Bryodixonia*, as well as numerous species of *Macromitrium* and *Orthotrichum*. Almost all are epiphytic mosses. The last two genera named are, however, abundant in lowland and montane areas, though *Orthotrichum* becomes decreasingly abundant with decrease in altitude and has many rupestral species.

The upper zones of the subalpine region beyond the forest line comprise mainly grasslands, herbfields, and fellfields, bare rock, or rock overlain with a thin soil veneer; but the presence of stream courses, bogs, swamps and talus slopes provides a diverse variety of habitats each peopled with characteristic species. To this area belong most of the Andreaeaceae and many of the Grimmiaceae, Tortulaceae, Bryaceae, Dicranaceae and Polytrichaceae. Lithophytes include six species of *Andreaea*, *Rhacocarpus humboldtii* and four species of *Rhacomitrium* as the commonest species, with several species of *Grimmia* also abundant. *Coscinodon australis* is known only from one area at Arthurs Pass in Canterbury.

Species from the stream margins or from emergent rocks in the stream bed include *Blindia tenuifolia*, *Bryum blandum*, *B. laevigatum*, *B. curvicollum*, *Breutelia pendula*, *Philonotis australis*, *P. tenuis* and *Tridontium tasmanicum* in the first category and *Andreaea australis* and its variety *aquatilis*, *A. nitida* and its var. *aquatica*, *A. sublata*, *A. acuminata*, *Blindia egmontensis*, *B. martini*, *Sematophyllum tenuirostre*, *Grimmia apocarpa* var. *rivularis* and *Tridontium tasmanicum* in the second. More rarely *Acrocladium sarmentosum*, *Climacium dendroides* and *Bryum scoparium* have been detected in similar habitats.

Fellfield mosses include *Conostomum australe*, *C. pusillum*, *Coscinodon australis*, *Dicranoweisia antarctica*, *Distichium capillaceum*, *Psilopilum australe*, *Dicranoloma robustum* var. *setosum*, *D. billardieri* and *Rhacomitrium lanuginosum* var. *pruinosum* as common members.

To the herbfield belong the two Dicranolomas just mentioned in a complex of forms, *D. obesifolium*, *Dicranoweisia antarctica*, *Polytrichum juniperinum*, *P. alpinum*, *Psilopilum australe*, *P. crispulum*, *Pseudodistichium buchanani*, *Tortula petriei* and *T. rubra* as common members.

Pleustic mosses of this zone include *Drepanocladus aduncus*, *D. fluitans*, *D. uncinatus* (less frequently), *Campylopus clavatus*, *C. bicolor*, *C. introflexus* and several species of *Sphagnum*. Bog mosses include the three species of *Campylopus* named above, *Rhacocarpus humboldtii* and *Rhacomitrium ptychophyllum* as the

more common members. *Pleuridium arnoldii* is a small moss occupying bare spots in grassland, and *Blindia magellanica* is common in seepage areas as well as on damp rocks.

5. Alpine Mosses. Few mosses are known from this zone, records being very meagre. The only mosses known to the writer from elevations exceeding 1850 metres are *Pohlia elatior* (2500 metres) on Mt. Ruapehu, *Rhacomitrium ptychophyllum* (2100 metres) on Mt. Rolleston, and *Andreaea rupestris, Blindia tenuifolia, Rhacocarpus humboldtii* and *Rhacomitrium lanuginosum* var. *pruinosum* from rather lower levels. So abundant and conspicuous on Mt. Ruapehu is the latter species where it grows in patches a metre across that climbers speak of reaching "The Moss" at a particular hour. All the above alpine mosses except the first named actually reach sea level in the south of Stewart Island. *Ceratodon purpureus, Campylopus clavatus, Funaria hygrometrica, Hypnum cupressiforme* and *Ptychomnion aciculare* have all been observed at elevations from sea level to over 1500 metres, but are not typical alpine mosses.

Ecological Factors in Influencing Distribution

As is well known, every moss has certain minimum requirements in respect to the character and pH of the substratum, to light intensity, to moisture, etc. which serve to restrict the distribution within its total range. Thus obligate calciphilous mosses are excluded from areas where calcareous rocks are absent or obligate epiphytes from treeless areas. Little or no experimental work has hitherto been undertaken in New Zealand to determine either the minimal or optimal requirements of any of the indigenous mosses in respect to any ecological factors involved, hence only the major aspects can be discussed at present.

A. The Edaphic Factor. There is sufficient evidence from overseas studies to demonstrate the close connection between the pH of the substratum and the moss species that can germinate or thrive upon it. While a majority of New Zealand mosses would appear to thrive best on acid substrates the following are restricted to calcareous substrates in New Zealand: *Aloina sullivaniana, Crossidium geheebii, Ditrichum calcareum, D. flexicaule, Eucladium irroratum, Gymnostomum calcareum* and its var. *longifolium, Grimmia argentea, Hyophila novae-seelandiae, Orthotrichum austro-cupulatum, Seligeria cardotii, S. diminuta, Tortula muralis* and *T. phaea. Fissidens vittatus* and *Encalypta vulgaris* are commonly found on calcareous rocks but are not obligate calciphiles.

Typical mosses of siliceous rocks include species of *Andreaea, Coscinodon, Grimmia, Hedwigia, Rhacocarpus, Rhacomitrium* and

Tetraphis. Mosses indicative of strongly acid soils include most species of *Dicranoloma*, *Leucobryum* and *Polytrichum;* but failing a pH survey further notes would be mainly conjective.

B. The Light Factor. Some mosses (*e.g., Atrichum lingulatum*, *Hypnum cupressiforme*, *Mnium longirostrum* or *Thuidium furfurosum*) have a wide tolerance of light intensity and are to be found equally in areas exposed to full sunlight or in forest shade. Most mosses are sciadophilous to some degree though a few can thrive on rock faces periodically exposed to strong insolation with consequent temperatures as high as 130° F. (*e.g., Grimmia pulvinaris*, *G. inaequalis*, *Orthotrichum pulvinatum*).

In such cases growth is arrested till fog or rain ensues. Of earth frequenting mosses capable of growing on very dry soils mention may be made of *Ceratodon purpureus*, *Leptodontium interruptum* and *Triquetrella papillata*, while of the epiphytic species usually growing in full sunlight examples are the species of *Leptostomum*, *Macromitrium* and *Papillaria* as well as such species as *Orthotrichum calvum*, *O. hortense*, *O. cyathiforme*, *Tortula abruptinervis* or *T. papillosa*. A majority of acrocarps grows in well lighted stations just as a majority of pleurocarps prefers a degree of shade.

Among the ground mosses that thrive in deep shade in forest zones the following are typical: *Eriopus cristatus*, *E. flexicollis*, *Fissidens rigidulus*, *Hypopterygium filiculaeforme*, *Pterygophyllum dentatum* and its variety *robustum*, *P. quadrifarium* and *Thamnium pandum*, all of the deepest green. Slightly less sciadophilous are *Sciadocladus kerri*, *S. menziesii* and numerous species of *Fissidens*. Of the epiphytes shade lovers include *Distichophyllum pulchellum*, *Mesotus celatus*, *Sematophyllum amoenum*, and the two Weymouthias and many others including the various species of *Rhizogonium* which carpet fallen logs and trees. *Tetraphis browniana* is confined to shady crevices in the lavas of Mt. Ruapehu.

C. Annual Rainfall. The rainfall on the West Coast of the South Island and on Mt. Egmont everywhere exceeds 125 cm. annually and in places exceeds 500 cm. In consequence virgin lands are almost everywhere heavily forested. On the eastern side of the Southern Alps the isohyet gradient falls steeply, and most of the area has an annual rainfall less than 125 cm. Forested areas are sparse and grasslands are usual save in settled and cultivated areas. Central Otago has an annual rainfall rarely exceeding 60 cm., and the characteristic scenery is of bare rock and thinly grassed areas or of tussock. Either directly or indirectly the distribution of the mosses is controlled mainly by the rainfall.

South Island Mosses Confined to Areas with an Average Annual Rainfall less than 125 cm.

Acaulon apiculatum
Astomum austrocrispum
Brachymenium preissianum
Desmatodon lingulatus
Dicranum scoparium
Ditrichum calcareum
Erythrobarbula binnsii
Fissidens taylori
F. vittatus
Funaria subcuspidata
Gigaspermum repens
Grimmia argentea
G. asperitricha
G. inaequalis
G. laevigata
Gymnostomum calcareum
G. calcareum var. *longifolium*
Hedwigia ciliata
H. integrifolia
Leptodon smithii
Macromitrium longirostrum var. *caducifilum*
M. orthophyllum
Neckera brownii
N. laevigata
Orthotrichum alpestre
O. cyathiforme
O. hortense
O. pulvinatum
O. sainsburyi
Physcomitridium readeri
Physcomitrium conicum
Plagiobryum novae-seelandiae
Pleuridium nervosum
Pottia arcolata
P. heimii
P. longifolia
P. macrophylla
P. maritima
P. stevensii
P. zealandiae
Pseudephemerum axillare
Pseudoleskea imbricata
Ptychomitrium australe
P. barrii
Rhynchostegium peracuminatum
Saelania glaucescens
Seligeria diminuta
Tortula abruptinervis
T. papillata
Triquetrella curvifolia
T. papillata
Ulota rufula
Zygodon minutus

South Island Mosses Confined to Areas with an Average Annual Rainfall Exceeding 125 cm.

Andreaea (all species except *A. rupestris*)
Anoectangium bellii
Atrichum ligulatum
Bartramia crassinervia
B. robusta
Breutelia elongata
Bryum harriotii
B. mucronatum
B. tenuidens
Campylopodium linearc
Campylopus arboricola
Catharomnion ciliatum
Coscinodon australis
Cryptopodium bartramioides
Cyrtopus setosus
Daltonia angustifolia
Dawsonia superba
Dendroligotrichum dendroides
Desmatodon viridipilus
Dichelodontium nitidum
Dicnemon semicryptum
Dicranella jamesonii
D. temperata
Dicranoloma obesifolium
Dicranoweisia spencerі
Dicranum trichopodum
Ditrichum brevirostrum
Entodon truncorum
Ephemeropsis trentepohlioides
Encamptodon inflatus
Fissidens adiantoides
F. muelleri
Homalia auriculata
Hypnodendron marginatum
Leptobryum pyriforme
Leptodontium interruptum
Mesotus celatus
Oligotrichum tenuirostre
Orthotrichum beckettii

Papillaria flavolimbata
Pleurophascum grandilobum var. *decurrens*
Polytrichum alpinum
Psilopilum australe
P. crispulum
Rhacomitrium striatipilum
Rhizogonium mnioides
Sematophyllum contiguum
Tortula petriei
Ulota bellii
U. membranata

Mechanisms of Dispersal

In general it is assumed that mosses enlarge their areas of distribution mainly by the production of spores. The intricate mechanisms of the peristome permitting spore dispersal only when conditions are favourable affords reason for adopting this view. Nevertheless every cell of the gametophyte seems capable of initiating a new plant and in many cases is the only method made use of. Special buds or broodbodies exist in not a few species as a further method of vegetative reproduction, and such organs are not restricted to non-space-producing species, as witness *Campylopus introflexus*, *C. clavatus* or *Orthorrhynchium elegans*. There are in New Zealand over 50 moss species which have never been observed bearing sporophytes or at most once or twice or rarely. These obviously propagate vegetatively, and it is noteworthy that with very few exceptions these plants are rare, or at best common in a very restricted area. One or two are locally common in areas far apart (*e.g.*, *Eucamptodon inflatus*). Thus it would appear that local abundance depends mainly on vegetative increase, but the wider dispersal is dependent on spore production.

1. Mosses Never Known to Fruit in New Zealand. *Archidium clatum*, *Aulacomnium palustre*, *Acrocladium sarmentosum*, *Bartramia alaris*, *Brachythecium albicans*, *B. subplicatum*, *Climacium dendroides*, *Cratoneuron filicinum*, *Dicranum scoparium*, *Ditrichum flexicaule*, *Drepanocladus fontinaliopsis*, *Eucamptodon inflatus*, *Fissidens vittatus*, *Haplohymenium huttonii*, *Hylocomium splendens*, *Mecsia novae-zealandiae*, *Papillaria amblyacis*, *P. flavolimbata*, *Pohlia elatior*, *Scleropodium purum*, *Thamnium baculiferum*, *Tortula papillata*, *T. laevipila*, *Triquetrella curvifolia* and *Zygodon rufescens*.

2. Mosses that Fruit very Rarely in New Zealand. *Acrocladium cuspidatum*, *Barbula pseudopilifera*, *Brachythecium salebrosum*, *Braithwaitea sulcata*, *Breutelia elongata*, *Ctenidium pubescens*, *Dicnemoloma sieberianum*, *Dicranoloma platycaulon*, *Drepanocladus aduncus*, *Eriopus apiculatus*, *Eurhynchium praelongum*, *Fissidens leptocladus*, *Homalia auriculata*, *Leptodontium interruptum*, *Macromitrium gracile* var. *retusum*, *M. longirostre* var. *caducipilum*, *Papillaria crocea*, *P. flexicaulis*, *P. nitens*, *Pseudoleskea imbricata*, *Rhacomitrium ptychophyllum*, *R. striatipilum*, *Polytrichum alpinum*, *P. formosum*, *Tortula abruptinervis*, *T. rubra*, *Sematophyllum homomallum*, *Trachyloma planifolium*, *Triquetrella papillata*.

There are a number of wide ranging species that fruit copiously in some areas and rarely in others. Thus *Calyptopogon mnioides* fruits rarely in the North Island but abundantly on the West

Coast of the South Island. The same is true of *Dendroligotrichum dendroides* save on Mt. Egmont. Apparently a high rainfall promotes sporophyte production. There are other species (*e.g.*, *Rhacomitrium lanuginosum* var. *pruinosum* or *Leucobryum candidum*) in which fruiting plants are relatively uncommon compared to the total in any area; yet such plants may bear very numerous sporophytes. Such species are usually abundant and widespread.

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OLIGOTRICHUM FALCATUM, A NEW SPECIES FROM ARCTIC ALASKA

WILLIAM CAMPBELL STEERE[1]

Oligotrichum falcatum sp. nov.[2] (FIG. 1-9). Plants silvery

[1] Dept. of Biological Sciences, Stanford University, Stanford, Calif. Grateful acknowledgment must be made here for generous research support. My field work in arctic Alaska in 1951 and 1952 was made possible through a contract between the Office of Naval Research and Stanford University. A generous grant made more recently by the National Science Foundation (G-2126) has allowed accelerated study of the collections from these and later field seasons.

[2] Dioicum?, robustum, dense caespitosum. Caulis humilis, 1-5 cm. altus, erectus vel ascendens e basi decumbente, rigidus, simplex vel dichotomus, innovando-ramosus, dense foliosus. Folia asymmetrica, secunda, falcata, imbricata, siccitate vix mutata, glauco-viridis et fuscescens, superne 1.5-2.5 mm. longa, inferne breviora, elongato-ovata et ovato-lanceolata, acuta vel apiculata, valde concava, margine eroso-crenulata, incurva, unde apicem versus subtubulosa; costa latior ad basin usque, lamellosa, subtus plus minus laevis, lamellis 8-16, undulatis, 4-12 cellulis altitudine; cellulae laminae subquadratae, laeves. Caetera ignota. Alaska; Brooks Range, Franklin Mountains: In saxis irroratis rivulorum regionis montanae in zonam arcticam.

green when wet and living, clear green when dry, but becoming reddish and then brown with age. Stems to 5 cm. in length, with a central strand, branching freely by innovations, prostrate to erect, forming dense mats or cushions. Leaves smaller and scale-like at base of plant, becoming gradually larger toward apex of stems and branches, the apical leaves of each season's growth conspicuously larger, firm, not undulate when moist, shrinking somewhat but little crispate or contorted when dry with the occasional exception of the youngest leaves, strongly arcuate-incurved and clearly and conspicuously falcate-secund, curving toward the substratum, asymmetrically ovate or ovate-lanceolate, 1.5-2.5 mm. long, averaging about 2.0 mm., 0.6-0.8 mm. wide, somewhat decurrent at the base, margins irregularly crenulate to obscurely serrulate by single blunt projecting cells, occasionally sharply toothed at the apex, widely incurved in the upper part or throughout, apex almost cucullate; costa about 160 μ wide at the base, 200-260 μ wide at about the middle, at its widest, then tapering to the apex, percurrent, ending in a straight mucro with a single pellucid terminal cell, occasionally sharply serrulate and more rarely obscurely lamellate on the dorsal side especially near the apex, costa in cross-section consisting of one dorsal layer of very large, thick-walled cells very similar to the cells of the lamina, although perhaps somewhat larger, a wide band (3-5 layers of cells) of very small, very thick-walled stereids, above which—or occasionally irregularly among which—are several central or irregularly arranged guide cells, and finally a ventral layer of large thin-walled cells upon which the lamellae are situated; ventral lamellae 8-16, all on the costa, often associated in pairs, extending nearly to the base of the leaf, undulate from side to side, crenulate to irregularly serrate on the free margin in side view, 4-12 cells high, the cells considerably larger than those of the lamina, in cross-section the marginal cell chlorophyllose, oval, and slightly larger, otherwise not differentiated, not papillose; lamina one cell thick throughout, lacking teeth or lamellae on the back except occasionally at the edge of the costa; cells of the lamina clear, transparent, chlorophyllose, marginal cells not differentiated, their cross-walls approaching the margin at right angles except for the protruding cells, upper leaf cells polygonal, hexagonal to quadrate, isodiametric or occasionally wider than long, 7-18 μ in diameter, short—rectangular in the basal part, rarely more than twice as long as wide, 7-18 μ wide × 18-35 μ long; cell walls smooth, conspicuously thickened, especially at the corners, transverse walls appearing thicker than the longitudinal ones. Female inflorescence terminal, perichaetial leaves similar to the others,

except for the innermost, which are much reduced in size, with a well-developed hyaline sheathing base and lower lamellae; archegonia 4-8 per cluster, with very long necks and showing no sign of fertilization; paraphyllia few, linear, brown; antheridial plants not found; sporophytes lacking.

LOCALITY DATA: Growing on rocky bottom and sides of small fast-flowing snow-melt stream near summit of limestone mountain at about 3000 ft. alt., west side of Peters Lake, southwest of Mt. Chamberlin, Franklin Mountains, Brooks Range, Alaska, aprox. 69° 22′ N. Lat., 145° 03′ W. Long., July 29, 1952, *W. C. Steere* 18959, TYPE (NY); on dripping vertical rock wall in crevice in cliff, same area, July 26, 1952, *W. C. Steere* 18689.

This moss occurred in great abundance in the type locality, and I immediately realized that this species was unknown to me and probably to science. However, no sporophytes or antheridial plants were found, even upon careful search. Until sporophytes are found, the generic position of this interesting moss cannot be settled finally. The clear and transparent leaves, the lack of lamellae on the dorsal side of the lamina, the cross-section of the costa, the incurved margins, the cucullate leaves, and the general aspect all suggest *Psilopilum*. The reddish coloration of older plants, the mucronate leaf apex, and the presence of occasional sharp teeth and small lamellae on the dorsal side of the costa near the apex suggest *Oligotrichum*, and I have adopted this generic concept here because of its greater comprehensiveness.

The conspicuously asymmetric and falcate-secund leaves are unique in the Polytrichaceae—at least, I have never seen a species in any genus of the family that shows these characteristics. The habitat is likewise unusual—submerged and emergent in fast-flowing water—although, of course, a few species of Polytrichaceae grow in very wet places or even in standing water. In the field, the submerged plants have a beautiful pale silvery-green appearance, from the air trapped in the large dorsal cell layer of the costa.

Oligotrichum falcatum obviously belongs to a group of species that make up a floristic element restricted in its geographic distribution to the very highest latitudes. Its discovery in arctic Alaska emphasizes the probability that it will eventually be found to occur also in the Canadian Arctic, especially in the Arctic Archipelago, and in Siberia. The generic position of this species will be clarified only when the sporophyte is discovered.

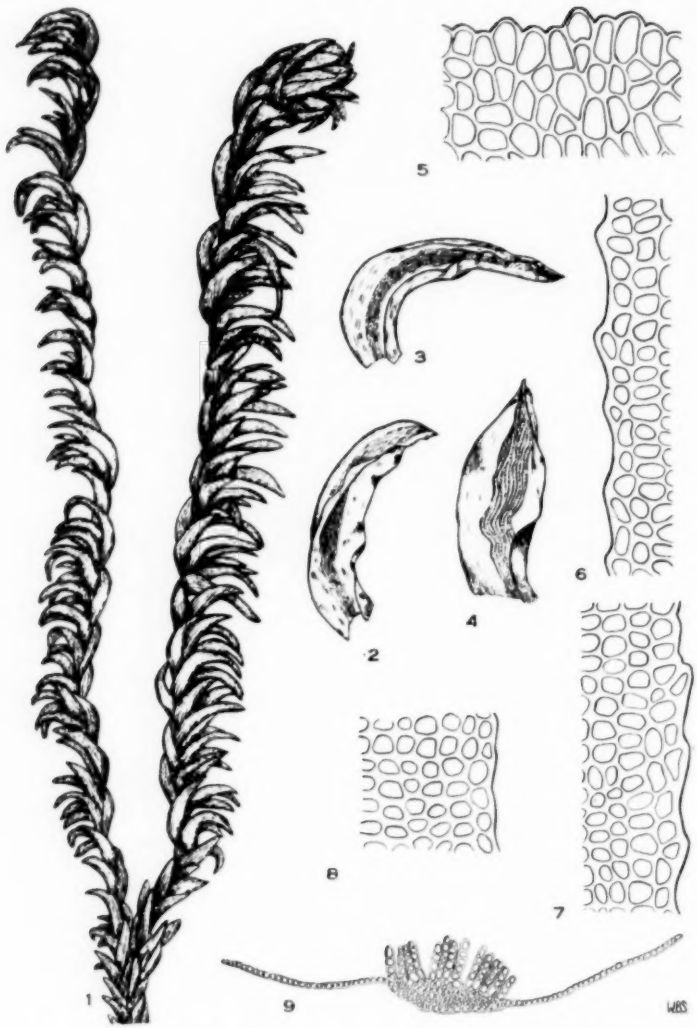

FIG. 1-9. *Oligotrichum falcatum* n.sp. 1. Habit and mode of branching of plant. × 3.3. 2-4. Leaves, showing shape and asymmetry, × 17. 5. Free margin of lamella, × 183. 6-7. Upper margin of leaf, at different levels, × 183. 8. Leaf margin in upper part of lower half, × 183. 9. Cross-section of leaf at about the center or slightly below, × 42. Acknowledgment is made to WILFRED B. SCHOFIELD who made the drawings by means of a camera lucida, calculated the magnifications, and prepared the plate.

THE DISCOVERY OF OREAS MARTIANA IN ARCTIC ALASKA: A GENUS NEW TO NORTH AMERICA

WILLIAM CAMPBELL STEERE[1]

Oreas martiana (Hoppe & Hornsch.) Brid., first collected in the Tyrolean Alps of Austria in 1817, now appears to be not uncommon locally in restricted areas of the central Alps of Austria and Switzerland. Gams (1932) has presented a full and enlightening account of its ecology and has mapped in considerable detail its geographic distribution in Europe. Eastward from the Alps, this monotypic genus has been reported to occur in the Caucasus; in Sikkim and Kashmir in the Himalayas; in Yünnan and Setschwan in west China; and in Japan. However, it has not been reported from the mountains of Scandinavia or previously from North America. As its generic name suggests, this moss grows at very high altitudes in the mountains—at six to ten thousand feet in the Alps, at 15,500 and 17,000 feet in the Himalayas (according to the data on two specimens in the Mitten herbarium), at 4000 meters in Yünnan, and at 4250 meters in Setschwan (Brotherus, 1929). The Alaskan collection was made at about 3000 feet above sea level, but of course this comparatively low altitude is much more than compensated for by the rigors inherent in a habitat at high latitudes, well north of the Arctic Circle.

I found this species in northern Alaska during the summer field season of 1952, and although I recognized it in the field as something totally new in my collecting experience, its identity did not then occur to me. My delay in reporting this interesting discovery has resulted primarily from serious doubts that arose in my mind concerning the conspecificity of the Alaskan moss with the European and Asiatic *Oreas martiana*—for reasons that will be elucidated. Most important, perhaps, is that the habit and habitat of the Alaskan moss are wholly different from the Old World moss; instead of growing on rock in deep, dense cushions obviously representing the gradually accumulated growth of many years, the plants form thin but rather extensive tufts over black humus and are not closely bound together with interwoven tomentum. Moreover, the bright yellowish-green plants and the clear, yellow-orange capsules with red ribs differ strikingly from the

[1] Stanford University, Stanford, Calif. I acknowledge gratefully the generous research support that has made possible the field work that has led to this paper, from both the Office of Naval Research and the National Science Foundation, as well as a more recent National Science Foundation grant (G-2126) that has allowed more rapid study of my extensive collections.

typical material and would seem to demonstrate rather clearly the relationship of *Oreas* to *Cynodontium*. The 35-40 specimens of *Oreas* from Europe and Asia in the herbarium of the New York Botanical Garden are uniformly brown and do not appear to have been conspicuously green at any time, even when alive.

A further important difference is that the standard European manuals describe the leaves of *Oreas martiana* as entire; in the Alaskan material the leaves are distinctly erose-dentate to clearly serrulate just below the apex, much as in *Ceratodon purpureus*. In young, actively growing plants the leaves are actually spinose-serrulate on the upper margins, and the winged margins farther down the leaf are irregularly serrulate. The leaves in general seem broader at the base than in typical alpine material, and the perichaetial leaves have more conspicuous shoulders and are more suddenly contracted to the subulate excurrent costa. However, after studying all the material available to me, I have come gradually to the conclusion that the distinctions are matters of degree rather than absolute differences; in fact, many of the European specimens show much more strongly erose-serrulate and -denticulate margins than most published descriptions would suggest.

Although in earlier times this Alaskan moss would undoubtedly have been proposed as a new species because of the geographic disjunction and the distinctive features just mentioned, I have concluded that it is only a geographic race or variety of *Oreas martiana*. My reasons for this very conservative decision are derived both from phytogeographic considerations and from morphologic structure.

The number of species that range eastward from the Alps through the Himalayas to China, Japan and eventually to Alaska, is already significantly large and will undoubtedly increase still more, with continued field work in Alaska and further study of present collections. A few illustrative examples from arctic Alaska are *Frullania jackii* Gottsche, *Didymodon rufus* Lor., *D. giganteus* (Funck) Jur., and *Mielichhoferia mielichhoferiana* (Funck) Limpr. Since *Oreas* presents an excellent example of this pattern of geographic distribution just indicated, its existence in Alaska could perhaps have been predicted, just as some of the apparently highly restricted mosses of the Alps should be searched for with especial care in Alaska. Moreover, it seems to me very unwise to propose new species in previously monotypic genera with a broad geographic distribution, since without doubt they represent extremely ancient types that had an even wider range at some much earlier time (Steere, 1953b; Gams, 1955).

The differences in appearance and habitat may well result from the very different growing conditions, from those in the Alps, north of the Arctic Circle, where day lengths are much greater—in fact, where no real period of darkness exists during the active growing season. Also, except for the tendency toward serrulate leaf margins, the microscopic structure of the Alaskan collection and that of typical material of *Oreas martiana* from the European Alps are remarkably similar. The cell sizes and shapes also agree closely, and the sporophytes are nearly identical, even to spore size and the tendency of some of the spores to remain loosely associated in tetrads after leaving the capsule. One remarkable characteristic of the leaves of *Oreas* that has received too little notice and that seems to be omitted from the description of this moss in standard and classical works (Bruch, Schimper & Gümbel, 1842; Limpricht, 1866; Mönkemeyer, 1927) is the bistratose margin, winged in much the same manner as the leaves of some species of *Syrrhopodon* (*fig.* 5, 8). This clear-cut character adds to the independent status of the genus *Oreas*.

In Alaska, only one colony of *Oreas martiana* was discovered during the exploration of many localities on the north slope of the Brooks Range in the field seasons of 1951, 1952 and 1953—an exploration that included the major mountain groups constituting the Brooks Range. An interesting geological sidelight that may be of significance in the occurrence of *Oreas* is that within the Brooks Range, which consists in very large part of uplifted sedimentary deposits, the *Oreas* locality is one of the very few where intrusive rocks appear. The habitat data follow: On black humus in a rather dry grassy tundra, on a very steep, north-facing mountain just S. of Peters Lake, a few miles SW. of Mt. Chamberlin, Franklin Mountains, Brooks Range, at about 3000 ft. alt., approx. 69° 22′ N. Lat., 145° 03′ W. Long., July 26, 1952, *Steere* 18731. On July 26, when *Oreas* was first seen in the field, the just mature, still operculate capsules were perfectly spherical, except for the small obliquely beaked operculum, and exactly inverted by the curved seta. The red longitudinal lines indicating those areas later to become ribs, alternating with yellow sectors, produced a pattern that gave the capsules exactly the appearance of minuscule globular cucurbits. Old weathered capsules and not-so-old deoperculate capsules of at least two previous years, as well as young spears of the succeeding year's sporophytes, accompanied the ripe capsules.

The discovery of *Oreas martiana* in the Schrader Lake-Peters Lake-Mt. Chamberlin area emphasizes the unusually exciting bryophyte flora of this particular locality in the Brooks Range,

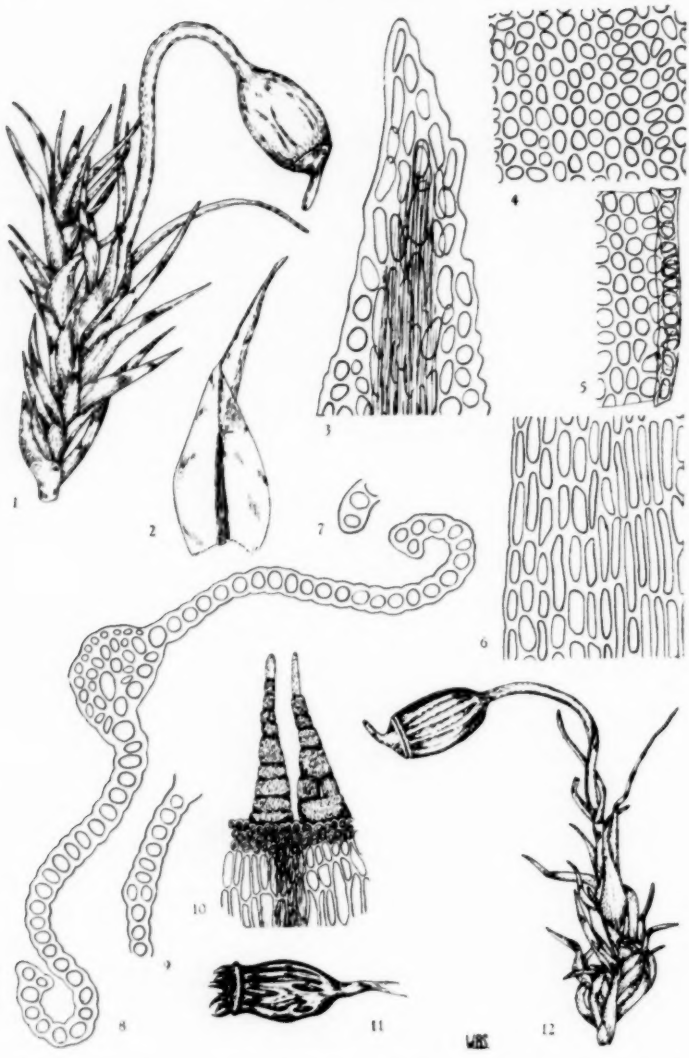

FIG. 1-12. *Oreas martiana*. 1. Habit of plant when moist, × 15. 2. Leaf from upper part but not apex of stem, × 17. 3. Detail of leaf apex, × 185. 4. Leaf cells from upper half of leaf, near costa, × 185. 5. Edge of leaf in upper half, showing revolute, winged margin, × 185. 6. Leaf margin, near base, × 185. 7-9. Cross-sections of upper part of leaf, all × 185. 7. Uni-

since within a few miles of the *Oreas* station occur, among many others of great interest, the following species: *Mielichhoferia mielichhoferiana* (Funck) Limpr., *Trematodon brevicollis* Hornsch. (Steere, 1952), *Oligotrichum falcatum* Steere (Steere, 1958a), *Bryobrittonia pellucida* Williams, with the first known sporophytes (Steere, 1953a), *Lepicolea fryei* Persson, *Scapania simmonsii* Bryhn and *Radula prolifera* Arnell with perianths, *Mnium andrewsianum* Steere (Steere, 1958b), *Philocrya aspera* Hagen & Jensen (Steere, 1956), and an interesting *Pterygoneurum* still incompletely studied. This area would clearly merit intensive bryological study during an entire field season, instead of the few days I could spend there. Although one of the most remote areas of arctic Alaska and noted for its bad weather, it is surprisingly easy of access because Schrader Lake, just west of Peters Lake and joined to it by an inlet, is large enough to accommodate the landing and take-off of airplanes equipped with floats.

Since this species is new to North America and is not included in any European manual written in English, I trust that American bryologists may find some usefulness in the accompanying illustrations, for which I am indebted to the perceptive eye and skillful hand of Wilfred B. Schofield.

To those who may differ with me in the wording of the title of this paper or in my references to *Oreas* as a monotypic genus, because of the existence in the literature of *Oreas mexicana* Thér., I should hasten to explain that my study of type material of the Mexican species shows it to be not an *Oreas* at all, but something quite different, probably a species of *Zygodon*. Its peristome teeth are wholly different in structure from those of *Oreas*, and its habitat, alone—on the bark of a tree—should justify my original suspicion concerning its correct generic placement in *Oreas*.

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stratose leaf margin as found above revolute, winged area. 8. Section through whole leaf, showing structure of costa and the typical bistratose winged margin. 9. Section showing occasional occurrence of a bistratose area within the leaf lamina. 10. External view of peristome and annulus, × 75. 11. Mature, dry capsule showing peristome and the ribs alternating with deep grooves, × 15. 12. Habit of dry plant, showing crisped leaves and ribbed capsule, × 15. (All drawings made by Wilfred B. Schofield, from *Steere* 18731.)

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ON DREPANOCLADUS BADIUS IN CONTINENTAL NORTH AMERICA

JAMES KUCYNIAK[1]

The taxonomy of *Drepanocladus,* a genus consisting as it does of a group of predominantly aquatic and subaquatic species upon which the seasonal fluctuations in water supply produce highly protean morphological aspects in individual plants, has long remained among the more difficult of the moss genera to undertake. Only a wide-ranging experience with these highly variable mosses could enable one to determine with reasonable certainty any of its duly described manifold variants. Just how acceptable were the numerous species, varieties and forms of *Drepanocladus* extant in literature remained a matter which only the serious and sharply critical monographer could assess with any accuracy. Only after a thorough study of the history, morphology, phylogeny, phytogeography and ecologic variations of as many of the described taxa as possible could such an authority appraise the status of each entity with any reliability.

In North America, Frances E. Wynne (1944a, b, c) has un-

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doubtedly published the best series of papers on *Drepanocladus* presently available to us since they offer the solution to an important number of problems in the genus. Her treatment of the many facets of the questions concerned is of lasting value since it introduces considerable simplification and provides thereby a more realistic and hence a practical approach to the taxonomy (Wynne, 1944d) of the genus. The results of her years of research have helped appreciably to remove *Drepanocladus* from the category of genera which many bryotaxonomists have neglected to pursue with more sustained interest on the grounds of the hopelessness of any satisfactory or critical approach to its systematics.

Wynne's taxonomic treatment has proved itself to be not only very workable to the author since it first appeared, but also supplies highly accurate geographic ranges for the majority of the species and varieties treated in her paper. These data have also been enhanced with maps on which the distributions of most of the species, combined with those of pertinent varieties, have been carefully plotted.

Unfortunately, such detailed treatment has not been accorded to three highly characteristic and phytogeographically significant species: *D. lycopodioides* (Brid.) Warnst., *D. badius* (Hartm.) Roth and *D. brevifolius* (Lindb.) Warnst. The fact that all three are limited to regions sparsely inhabited or of difficult access might well account for the lack of any substantial representation of them in herbaria. The author (Kucyniak, 1955) has made an attempt to add to the little information available on *D. brevifolius* in a paper published elsewhere. With the same purpose in mind, he here undertakes the study of the distribution of *D. badius* in North America in the hope that it will bring some documentation to the queries concerning this species which Wynne (1944d, p. 177) raised in her paper.

Though a highly protean genus, as stated above, most species of *Drepanocladus* are readily recognizable as belonging to it. None is, in spite of the variations it may present, less manifestly *Drepanocladus*-like to the naked eye, while remaining all the more distinct to the trained worker, than *D. badius*, reasons for which the author will give below. Its leaves do not seem to agree fully with every specification in the alternative "Leaves having single costa to middle or beyond and slenderly pointed, with few exceptions falcate-secund," with which A. J. Grout (1931), early in his key to the Amblystegieae, isolates *Drepanocladus* from neighboring genera. This can easily lead the student astray unless he realizes that though the leaves of *D. badius* tend at times to be so slightly falcate as to appear almost straight, they maintain a

sufficiently recognizable trace of unilaterality to warrant placing undetermined material of it in *Drepanocladus* rather than in any of the other closely related members of the Amblystegieae. Precisely because of the short, ovate leaves, their position on either stem or branch and the coppery *"firnisglänzenden"* (Brotherus, 1923, p. 481) tufts does the species remain readily recognizable when one is accustomed to its macroscopic aspect. So singular are the general morphological traits in this species that V. F. Brotherus (1908) set it apart from the other species by creating for it the subgenus Pseudo-Drepanocladus.

Any study involving *D. badius* will inevitably bring up for consideration two other species, *D. brevifolius* and *D. lycopodioides*, to which taxonomically it is most closely allied. All three have in common a number of important diagnostic features which immediately set them off from the rest of the genus so that, in the final analysis, the problem of identification is reduced to the relatively simple one of having to separate one of the three from the others. *D. lycopodioides* being by far the most robust, its macroscopic appearance alone can serve to distinguish it. However, an examination of the cell walls and costa under the compound microscope remains the best means of separating the three species. The cells of *D. lycopodioides*, though porose only in the basal portion of the leaf, have strongly incrassate walls throughout. Leaves of *D. brevifolius*, which show a forking costa, do not have their cell walls thickened throughout. In *D. badius*, the markedly unicostate leaf has its walls incrassate and porose throughout.

Described by C. J. Hartman (1849) from two Swedish specimens, one collected by H. Holmgren at Ananasfjell[2] and the other by P. O. Liedström at a locality determined only as "Dal.," *D. badius* well within the century following its discovery has had stations reported for it in Asia and Europe, Bear Island, Spitzbergen and Greenland. Without fear of contradiction, its distribution may be regarded as circumpolar in boreal latitudes. Within that period, Brotherus (1925), however, cited Labrador as the only continental North American station known to him. Quite recently, Wynne (1944d), without quoting any pertinent bibliographical reference, asserted: "In the literature, Labrador (Allen) is also cited for North America, but I have not seen the material." Very scant literature, skeletal at most, exists on J. A. Allen's contribution to bryology. In the somewhat limited bryological

[2] Dr. Askell Löve, of the Institut botanique, Université de Montréal, to whom the author is indebted for information relating to the type description, observes that "Ananasfjell" is now called Ananasvar (or Ananasse). It is situated slightly north of Jokkmokk, hard by Porjus and Stora Lule.

literature available to the author, the first report on Allen's collection of *D. badius* appears to be what John Macoun (1892) listed under *Hypnum badium* in his *Catalogue of Canadian Plants*. A painstaking search through the herbarium of the New York Botanical Garden, undertaken by Dr. D. P. Rogers, then Curator of the Cryptogamic Herbarium, and his clerical staff, has finally relocated three apparently long-overlooked packets of presumably the same collection made by Allen, on August 2, 1882, at Anse au Loup, Labrador. Quite possibly this gathering has served as foundation for and now substantiates the first reports of the New World occurrence of *Drepanocladus badius*.

The North American distribution provided by Wynne (1944d) contains no more detailed listing of localities than the mention of Greenland, Yukon Territory and Baffin Island. The scant information on distribution available to her may have deterred her from plotting the range of the species on a map. Soon after, W. C. Steere (1948) defined the North American sector of the general distribution of *D. badius* as spreading "from Alaska to Ellesmere and southward" but refrained from setting the meridional limit to this range owing to the still scant representation of *D. badius* under that name in herbaria. Previous to the appearance of his highly important contribution to our knowledge of Canadian Eastern Arctic mosses, apparently only the collections made by H. G. Simmons during the course of the Second Norwegian Expedition in the *Fram* (Bryhn, 1907) and those by Macoun (1892, 1902) were mentioned in North American literature. Steere, therefore, is to be credited for having considerably broadened its New World range by listing a number of previously unreported stations which extend from the Koukdjuak River, Central Baffin, as far south as Chesterfield on the west coast of Hudson Bay.

One can now safely give even greater credence to Allen's collection from the Ungava area. Several specimens of *D. badius* from other stations in northeastern America lying east of the Hudson and James Bays have since been collected: Fort Chimo, owing to a few strands which Howard A. Crum isolated from an A. P. Low collection distributed as Macoun's *Canadian Mosses* 165a as *Aulacomnium palustre* var. *imbricatum*;[3] two stations in

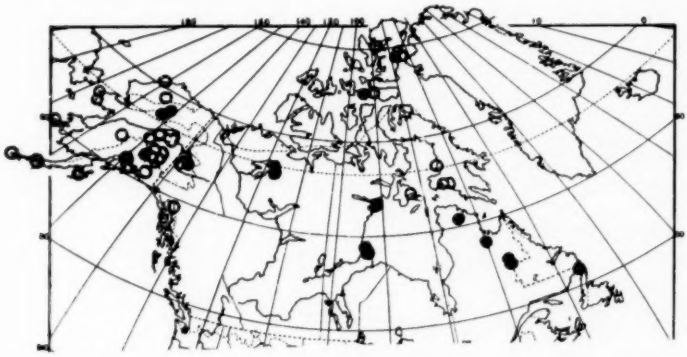
[3] In the Marie-Victorin Herbarium, Université de Montréal, there is another collection, also distributed as Macoun's *Canadian Mosses* 165a, the legend of which reads "In a bog Bonanza Creek, Yukon. July 18, 1902, John Macoun." Though determined by N. C. Kindberg as *Aulacomnium palustre imbricatum*, the material unquestionably is *Aulacomnium turgidum*. This is also true of A. P. Low's collection, Dr. Crum having detected the misidentification at the time he isolated the strands of *D. badius* from the specimen.

central Ungava, *viz.*, Lake Marymac and Knob Lake, through collections made by John F. Grayson in 1953, while only this past summer, several meagre threads of it were isolated from a scattering of bryophytes which Paul Martin collected at Little Eclipse Lake in the vicinity of Chubb Crater.

Specimens Examined

Northwest Territories: Cornwallis Island: Resolute Bay, 1949, *Henry B. Collins, Jr.* 5B (CAN). Chesterfield, A. Dutilly 656, with *Calliergon sarmentosum* and *Drepanocladus revolvens* (MICH). *Id., A. Dutilly* 656, with *Calliergon sarmentosum* and *Drepanocladus exannulatus* var. *exannulatus* (FH). Port Radium, 66° 05′ N., 118° 02′ W., in moist sedge bog, shore of Dumpy Lake, 1 July 1948, *William C. Steere* 10015 (CAN). *Id.*, in trail through spruce swamp, SE. side of Crossfault Lake, 3 July 1948, *Steere* 10079, with *Drepanocladus revolvens* (CAN). *Id.*, at edge of water in marshy lake, near Glacier Bay, 5 July 1948, *Steere* 10175 (CAN). *Id.*, at edge of small pool in swamp, drainage of McDonough Lake into Great Bear Lake, 24 July 1948, *Steere* 10457, with *Paludella squarrosa* (CAN). *Id.*, bogs and cliffs between Labine and Glacier Bays, in bog, 5 July 1948, *James Kucyniak* 48-50 (CAN). Hunter Bay: among other mosses in boggy place near small stream east of Sloan River, near its mouth, 31 July 1948, *Steere* 10635, with *Calliergon sarmentosum* and *Drepanocladus revolvens* (CAN). Yukon: Dawson, creek by West Dawson, July 30, 1899, *R. S. Williams* 795, with *Ptilidium ciliare, Paludella squarrosa* and *Calliergon sarmentosum* (NY). Hunker Creek, in a bog, July 29, 1902, *John Macoun* 343, with *Ptilidium ciliare* and *Calliergon sarmentosum* (NY), 343 and 10687, with *Ptilidium ciliare* (CAN), 403, with *Ptilidium ciliare* (MICH, MT, NY), with *Ptilidium ciliare* and *Drepanocladus revolvens* (FH) and with *Ptilidium ciliare, Blepharostoma trichophyllum* and *Calliergon sarmentosum* (CAN). Alaska: Anchorage, bog, July 10, 1948, *Ernest Lepage* 22519 (LEPAGE). Bettles and vicinity, Carter's cabin, approx. 10 miles from Bettles, on the John River, on soil in wet pot-hole, shade, *Sphagnum, Ledum, Vaccinium*, spruce and dwarf birch, August 4-12, 1951, *Elizabeth Sherrard*, 23-3, with *Sphagnum capillaceum* var. *tenellum* (CAN). Wiseman and vicinity, on wet mud on niggerhead, exposed, trail northeast of first lake on east side of river at Wiseman, August 13-25, 1951, *Sherrard* 15-22, with *Paludella squarrosa* and *Drepanocladus revolvens* (CAN). Vicinity of Umiat, August 10, 1953, *Larry Bliss* (CAN). Tangle Lakes, ridge and summits ca. 5 miles east and northeast of Tangle Lake, forming mats in small rivulet, 21 August 1953, *Galen Smith* 2052a, with *Meesia uliginosa* and *Drepanocladus revolvens* (CAN). Labrador: L'Anse au Loup, Lat. 51° 01′, wet ground, 2 August 1882, *J. A. Allen*, with (?) *Leiocolea schultzii* and *Campylium stellatum* (NY). Quebec: Fort Chimo, in a bog, 27 August 1896, *A. P. Low* (CAN). Vicinity of Knob Lake, 54° 47′ 30″ Lat., 66° 48′ 30″ Long., common on hummocks of *Carex aquatilis-Scirpus cespitosus* floating mat of bog in area about 2½ mi. N. of Knob Lake, June 21, 1953, *John F. Grayson* 5019 (MTBG). Vicinity of Marymac Lake, 57° N., 68° 33′ W. abundant in *Myrica gale-Scirpus hudsonianus* zone of bog about ¼ mi. E. of Lake Marymac, July 23-27, 1953, *John F. Grayson* 6040, with *Scorpidium scorpioides* (MTBG). Vicinity of Chubb Crater, Eclipse Lake, 1957, *Paul Martin* (MTBG). Ontario: Cape Henrietta Maria, *W. K. W. Baldwin* A-23a, with *Sphagnum warnstorfianum* and *Aulacomnium turgidum*, A-27a, with *Ptili-*

dium ciliare, *Aulacomnium turgidum* and *Hylocomium splendens* (CAN). MANITOBA: 3 mi. from Fort Churchill, swampy margin of small lake, June 26, 1956, *Howard A. Crum & Wilfred B. Schofield* 6678 and 6699, with *Bryum* sp. and *Drepanocladus fluitans* var. *fluitans* (CAN). Twin Lake Hill, ca. 20 mi. SE. of Fort Churchill, margin of pool, open area in lowland black spruce boggy area, July 5, 1956, *Crum & Schofield* 6898 (CAN). *Id.*, in pool and at its margin, open area in black spruce forest, July 5, 1956, *Crum & Schofield* 6917, with *Calliergon sarmentosum* (CAN). *Id.*, in wet area near lake, lowland boggy black spruce forest, July 5, 1956, *Crum & Schofield* 6922 (CAN).



MAP 1. The distribution of *Drepanocladus badius* in continental North America. (Hall's Outline Map 205 C used as base.)

The map on which the author has plotted the North American stations of *D. badius* takes into account all of the above, indicated with a solid point, and incorporates as well those, represented by means of an open circle, reported in the literature (Macoun, 1892, 1902; Bryhn, 1907; Persson, 1947; Persson & Gjaerevoll, 1957; Steere, 1948, 1951; Eyerdam, 1952; Holmen, 1953; Sherrard, 1955, 1957). Though Grout (1931) considered *D. badius* as a subarctic element, its distribution as illustrated above rather indicates it to be arctic in character.

A species of wet though not permanently submerged habitats, *D. badius* is frequently found, as Olle Mårtensson (1956) observes, in the more shallow parts of rich or poor fens. Likewise, it occurs in seepage areas such as "percolation streaks and irrigated rock surfaces." In such habitats it forms loose deep tufts. Mårtensson, who has greater field experience with the species than the author can now claim, stresses that in the Torneträsk region in Swedish Lappland "carpets which are completely free from other mosses are more rarely seen." In his examinations of herbarium specimens, with due recognition to the restricted sampling such

normally represent, the author found the tufts of this pleurocarpous moss more frequently homogeneous. In eleven of the samples studied, no other bryophyte was found associated with the species. In the remainder, *D. badius* was frequently associated with a single moss or hepatic: *Paludella squarrosa, Calliergon sarmentosum, Drepanocladus revolvens, Ptilidium ciliare* or *Sphagnum capillaceum* var. *tenellum*. In other packets, the association was a combination with any two of the aforementioned species, *i.e., Calliergon sarmentosum* and *Drepanocladus revolvens; Ptilidium ciliare* and *Calliergon sarmentosum;* or *Paludella squarrosa* and *Drepanocladus revolvens*. Or even of two more species not mentioned earlier: *Bryum* sp. and *Drepanocladus fluitans* var. *fluitans*, or (?)*Leiocolea schultzii* and *Campylium stellatum*. In the collections of *D. badius* made by Macoun in the Hunker Creek region, Yukon, it formed a part of a mixture of five species, *Ptilidium ciliare, Blepharostoma trichophyllum, Calliergon sarmentosum* and *Paludella squarrosa*. In the material revised, the author observed its most frequent associates to be the following: *Calliergon sarmentosum* and *Drepanocladus revolvens*, which occurred in six samples; *Ptilidium ciliare* and *Aulacomnium turgidum* in four; *Paludella squarrosa* in three; *Meesia uliginosa, Scorpidium scorpioides,* (?)*Leiocolea schultzii, Campylium stellatum, Bryum* sp., *Drepanocladus fluitans* var. *fluitans, D. exannulatus* var. *exannulatus, Sphagnum capillaceum* var. *tenellum, Sphagnum warnstorfianum* and *Blepharostoma trichophyllum* in one.

D. badius seldom produces sporophytes (Brotherus, 1925), which Mårtensson concludes as being "rare in proportion to the frequency," an observation which applies equally well to all of the North American plants which the author has revised in the course of the present study. Since we have very little information on the phenology of this species, it might be worth recording that material collected by Williams in the Yukon on July 30, 1899 bears fully ripened capsules while those on the specimens gathered by Crum and Schofield in northeastern Manitoba on July 5, 1956 show the well-developed capsules to be still green and immature. However, this does not imply an approximately four-week period for spore maturation in *D. badius*. One need only note that more than a half-century separates Williams' from Crum and Schofield's collections. Furthermore, reference to the mean temperatures recorded for these two widely separated areas in Canada will show an appreciable difference in the climatological conditions which prevail in both localities during the month of July.

The author expresses his grateful appreciation to Drs. Howard A. Crum, I. Mackenzie Lamb, E. B. Mains and D. P. Rogers for granting

the loans of the specimens listed above from their institutions: respectively, the National Museum of Canada, Ottawa; the Farlow Cryptogamic Herbarium of Harvard University, Cambridge, Mass.; the University Museums, University of Michigan, Ann Arbor, Mich.; and the Cryptogamic Herbarium, New York Botanical Garden, New York. To Dr. Crum, Mmes. Maila Lamb and Rosalie Weikert, the author is even more especially indebted for having taken an interest beyond the line of duty in facilitating the author's research in connection with the present study. To his Montreal colleagues, Mmes. W. Alan Kennedy and Rita Dubé, and Messrs. Marcel Raymond and Marcel Gougeon, the author extends his sincere thanks for valuable assistance rendered. It is, moreover, a pleasure to acknowledge that Father Ernest Lepage, École Moyenne d'Agriculture, Rimouski, P.Q., has again most kindly made available his valuable cryptogamic herbarium to the author.

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NOVITAS BRYOLOGICA. VII.
PLEUROCARPY IN POLYTRICHUM COMMUNE VAR. ULIGINOSUM

ISTVÁN GYÖRFFY[1]

Each year from 1904 to 1942 I spent 60-65 days, throughout July and August, in the High Tatra range of the northern Carpathian mountains, where my family kept a summer home, "Lersch-villa," near Barlangliget-Kotlina.

Many *Sphagnum*-rich habitats are found around the base of the Alta Tatra on morainal deposits of the Terrasse-diluvium of the Wurm period (Uhlig, 1897, 1900; Partsch, 1923), and I discovered many monstrosities among the bryophytes of those habitats, including some in various species of *Polytrichum*. For the most part these monstrosities were of rather common occurrence, but in 42 years I found but one example of a pleurocarpous form of *Polytrichum commune* var. *uliginosum*. The specimen was collected on July 12, 1927, in a hanging bog at the base of the High Tatra, near "Lersch-villa" (between Barlangliget and Rokusz), at an elevation of 760 meters above the sea.

Polytrichum commune is normally dioicous and acrocarpous (Sturm, 1815-18, *pl.* 24, *fig.* 5*b*; Bruch, Schimper & Gümbel, 1844, *pl.* 425, *fig.* 1 β. 1.). The female plants may be uniformly foliate (Bruch *et al.*, *l.c.*, *fig.* 1; Grout, 1900, *pl.* 11, *fig.* 2*b*), or may show a bicyclic periodicity (Hagerup, 1935; *cf.* *"Wachstum-Rhythmus,"* Lackner, 1939) because of the production of vernal and aestival leaves (Grout, 1898, *fig.* a; Elenkin, 1909, *pl.* 3, *at left*; Jennings, 1951, *pl.* 33, *upper right*, *fig.* *P*; Grout, 1924, p. 44, *fig.* 7, *at right*., Meusel, 1935, p. 145, *fig.* 8*c-e*). On male plants, the perigonial leaves are clearly differentiated (Bruch *et al.*, *l.c.*, *fig.* 4). The archegonia are pro-

[1] Állani Szanatorium, Csákvár, Fejér, Hungary.

duced at the tip of the stem, and, therefore, on the production of a sporophyte the stem ceases to grow. A male plant, however, continues to grow by proliferation from the center of the perigonium.

The pleurocarpous *Polytrichum* from the High Tatra is shown in figure 1; the secondary growth of the gametophyte extended as an innovation 27 mm. beyond its origin at the base of the sporophyte. The sporophyte was quite retarded in development and at maturity was smaller, weaker and more tender than normal; the capsule was somewhat smaller and the seta slightly shorter. In figure 2 the leaves have been removed in the vicinity of the perichaetium to show the dichotomy formed by the bases of the seta and the innovation.

From my special studies on teratology in mosses I would interpret this case of pleurocarpy, as follows: The plant originally had archegonia at the apex of the stem in the usual manner. The archegonia remained for a long period of time. Meanwhile some favorable environmental factor stimulated the slow growth of the stem from below. Thus a small bunch of leaves and the entire stem apex with the archegonia were displaced to one side. With the tardy fertilization of a single egg a sporophyte began to develop. The continued upward extension of the stem turned the stem tip and the base of the sporophyte completely to one side.

Figure 3 shows a longitudinal section at the original stem apex. The leaves at *B* and *C* were in one horizontal plane before the growth of the innovation (at upper left) caused a lateral dislocation. Before the initiation of secondary growth the stem was not narrowed below the perichaetium, and the latter was never narrowed at its base (or gemmiform) as in a normally lateral inflorescence. For that reason an equal ramification, similar to a dichotomy, resulted.

The upward extension of tissues and resultant dislocation by growth from below is not unique; it is in this way that the epigonium originates, as shown by Hy (1884). Similar phenomena among mosses are the dislocation of archegonia to the vaginula (common), the dislocation of archegonia to the pseudopodium (very rare) and the dislocation of leaves to the upper portion of the vaginula (rather rare). (Many examples of these are figured in my unpublished *Handbuch der Moosteratologie*, which includes some 15,000 original illustrations.)

The hereditary characteristics of *Polytrichum commune* evolved during a long period of selection; Cretaceous, Tertiary and Neophytic fossils are reported by Lam (1948, 1952), and Dixon (1927) reported fossils from Diluvial, Interglacial and Quaternary

FIG. 1-3. Pleurocarpy in *Polytrichum commune* var. *uliginosum*. 1. Plant, × 1. 2. Plant partially denuded of leaves to show dichotomy into base of sphorophyte (*at right*) and base of innovation (*at A*), × 2. 3. Longitudinal section; *B, C*, leaves of primary stem originally at the same horizontal level; innovation at left; vaginula at right.

deposits. The essential biological features of the species are, as follows: The plants are heliophytes, tall, robust and firm, and they require considerable space which is occupied fully by means of

subterranean stems or "rhizomes." Abundant nutrition is effected with the aid of the well-developed "rhizomes," as well as the large and well-differentiated capsules.

In the stems the mestome, consisting of leptome (or cribral) and hadrome (or vasal or hydroid) tissues, is developed to a high degree. (In figure 3 the mestome shows clearly as a darker central strand which continues from the original stem into both vaginula and innovation. The central cavity shown in the vaginula was caused during sectioning when the foot of the sporophyte was torn away from surrounding tissues.) A comparison of longitudinal sections of the Tatra plants with those of normal plants has shown the stem structure of the innovation to be typical in every way. (Lorch, 1908, 1931, carefully compiled detailed information on the anatomy of *Polytrichum commune*, both from his own observations and those of other workers.)

I am grateful to the following: the late Dr. József Gelei, my friend and colleague, professor of zoology at the University of Szeged, for the preparation of microtome sections; Dr. István Mihältz and Dr. Erzsébet Kol for making a series of microphotographs in 1928 during my stay at Szeged; the Rockefeller Foundation for laboratory instruments used at Szeged; †Elizabeth G. Britton, †H. N. Dixon, O. Hagerup, O. E. Jennings, †L. Lackner, H. J. Lam, †W. Lorch, H. Meusel, K. Mothes, J. Pottier and †K. von Schoenau for assistance with the literature. The Rev. Dr. József Erdös kindly revised the manuscript, written in Latin; it was later translated by H. A. Crum, with generous assistance from the Foreign Language Division of the Canadian Department of State.

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ANACAMPTODON IN NORTH AMERICA

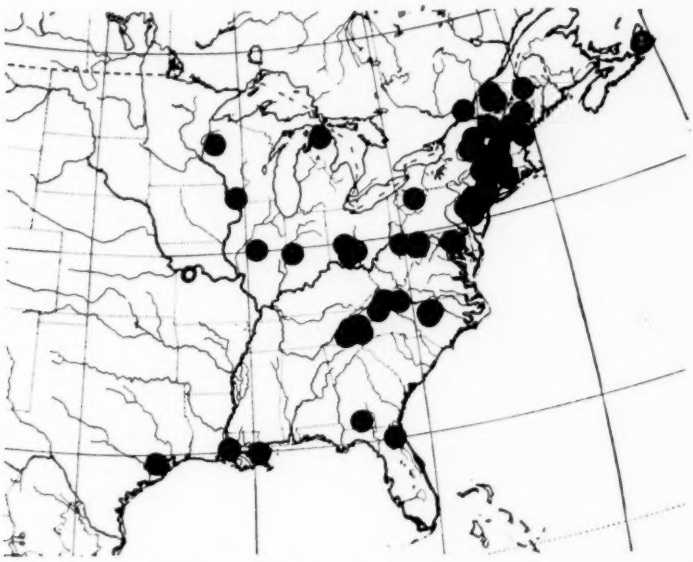
HOWARD CRUM[1]

The Knot-hole Moss, *Anacamptodon splachnoides* (Froehl.) Brid., appears to be rare and local in distribution. At least, it is not often collected even by experienced field bryologists, and many a note has been published to report its discovery in various parts of the eastern United States. Like other supposedly rare bryophytes, such as *Lindbergia brachyptera* and *Buxbaumia aphylla*, it may not actually be so rare as it is overlooked, either because it is not generally recognized or because its habitat is not well understood. This possibility is strongly suggested by the widespread occurrence of the species in eastern North America, as shown on the accompanying map.

In an attempt to determine the American range and ecology of *Anacamptodon*, I have studied nearly every collection reported in the literature. I have seen all the material in the herbaria of the New York Botanical Garden, the National Museum of Canada, Duke University, the Montreal Botanical Garden and the Universities of Montreal, Michigan, Tennessee, Wisconsin, Minnesota and Toronto, plus a few important specimens lent me by Brother Fabius and Winona Welch.

Grout (1928-40) gave the range as "Maine to Illinois, south

[1] National Museum of Canada, Ottawa.



MAP 1. The American distribution of *Anacamptodon splachnoides*. The open circle in Missouri represents an unconfirmed record.

to the Gulf States." This can be revised as follows: Nova Scotia and Quebec; Maine to Wisconsin and southward to northern Florida and eastern Texas. Citations to the many specimens seen would serve no useful purpose, except in the case of range extensions and apparent range limits, as follows:

NOVA SCOTIA: In a wet knot-hole of a birch on the Barrasois River, Cape Breton Island, *George E. Nichols* 098, August 6, 1909 (NY; CAN).

QUEBEC: On maple, Upton, Bagot Co., *A. Beaulac*, November 22, 1931 (MTBG); crotch of tree near Pointe Como, Vaudreuil-Soulange Co., *F.-H. Dupret*, August 25, 1905 (MTBG); on maple, near Waterloo, Shefford Co., *Bro. Anselm* 1614, July 17, 1937 (in herb. Bro. Fabius) and *Bro. Anselm*, September 1938 (TRT); base of tree, Waterloo, *Bro. Anselm* 2328, June 22, 1938 (in herb. Bro. Fabius); base of tree in crevice, Waterloo, *Bro. Anselm*, June 11, 1938 (TRT; MICH; NY; CAN); on tree, Waterloo, *Bro. Anselm*, July 17, 1938 (TRT); on *Acer saccharophorum*, Mont Yamaska, Rouville Co., *Bro. Fabius*, May 24, 1951 (in herb. Bro. Fabius).

WISCONSIN: On the live rim of a small knothole on a yellow birch, with *Leskea austinii*, in wooded swamp 2 mi. south of Barron (4-mile swamp), Barron Co., *L. S. Cheney* 11046, January 18, 1926 and 11066, February 20, 1926 (WIS); on decayed wood in bottom of large knothole, same locality, *Cheney* 11053, January 30, 1926 (WIS); same locality (without ecological data), *Cheney* 11116, April 13, 1926 (WIS); near a knot-hole in a living

yellow birch tree trunk, same locality, *Cheney* 12546, November 14, 1927 (WIS); in knothole in yellow birch tree, same locality, *Cheney* 13119, May 13, 1931 (WIS); on living bark in bottom of healed wound on white elm tree, high ridge near Potosi, Grant Co., *Cheney* 11450, June 12, 1926 (WIS).

FLORIDA: Knot-hole, St. John's River, north of Green Cove Springs, Clay Co., *L. E. Anderson* 5469, April 6, 1937 (DUKE; TRT).

TEXAS: Hollow of a live tree where water was standing, Waller Co., *F. W. Thurow* 23, March 25, 1893 (WIS).

Two other specimens with incomplete data are of interest: "*Splachnum setaceum*, Canada, *Schweinitz*" (NY); "Texas, *Ravenel*, April 1869 (NY).

I have been unable to locate the specimen from Lafayette Co., Missouri, reported by Chamberlain (1919) as var. *taylorae* Grout, and L. J. Gier has written me that he has seen no specimens from that state.

The range is summarized in the accompanying map. Collections of *Anacamptodon splachnoides* have been seen from Nova Scotia and Quebec; Maine, New Hampshire, Vermont, Massachusetts and Connecticut; New York, New Jersey and Pennsylvania; Ohio, Indiana, Illinois, Michigan and Wisconsin; Tennessee, Virginia, West Virginia, North Carolina and Georgia; Florida, Louisiana and Texas.

Grout (1947) characterized the habitat of *A. splachnoides*, as follows: "It is most frequently found growing in knot-holes in deciduous living trees (oak, apple, maple, etc.) where there is decayed wood that is soaked with moisture a good part of the time. It is well to look for it on sugar maple shade trees that have split so that water collects in the cleft and gradually seeps down the trunk." This is an excellent statement, in most respects. It is unfortunate, however, that apple trees were given emphasis. I have seen only one specimen from apple; it was collected at Newfane, Vermont, by Grout on July 16, 1911. For many years I have made a special point of searching carefully for *Anacamptodon* on the trunks of apple trees, but quite unsuccessfully; in spite of their characteristically gnarled trunks and abundant knot-holes, apple trees seem quite unsuitable for this species. Also, although several collections have been made on oak trees, the hard bark and generally dry situations in which oaks thrive would also seem to make them an unlikely habitat for *Anacamptodon*.

No exact statistical analysis of habitats can be given. A large number of specimens are lacking in such data, and it is impossible to say how many different collections were actually seen because of apparent vagaries exhibited in labelling specimens distributed as duplicates, without collecting numbers or other means of establishing their identity. However, the following figures give some indication of ecological preferences:

Of all specimens bearing ecological data, 83 came from trees,

11 from stumps, logs or decayed wood, two from old fungi growing on trees and one from the "forest floor." Almost all the collections from trees seem to have come from the trunks; the bases, branches and exposed roots of trees were mentioned only rarely.

Only two specimens came from the bark of an evergreen species; they were collected on the living stump of a hemlock kept alive by root grafting (Demarest, New York, *C. F. Austin*, January 24, 1874 and June 1874).

The kinds of trees include maple (19 collections; nine on *Acer saccharum;* two on *A. rubrum*); birch (seven; five on *Betula lutea;* one, from North Carolina, on "red birch"); beech (six); oak (five; one on *Quercus alba;* one on *Q. borealis*); buckeye (five; one on *Aesculus octandra;* one on *A. glabra*); hickory and elm (two each); *Nyssa*, apple, chestnut, walnut, sycamore and, from New Jersey, "gum" (one each). Of logs and stumps, hemlock, elm and beech were specified.

It is with some justification that *Anacamptodon splachnoides* has been called the Knot-hole Moss. Thirty-nine of the specimens bearing any specific ecological information came from knot-holes. The remainder were associated with damp, often rotted bark; 27 were recorded from drainage channels, cavities, hollows, crevices, cracks, holes, notches, crotches or damp spots on trees, all of which offer the same protection given by knot-holes.

Anacamptodon splachnoides is quite variable in its leaf characteristics. Throughout its American range, specimens are frequently found with longer and relatively narrower leaves with longer cells and a variable costa sometimes extending well into the acumen. (The leaves in this form are, in fact, very like those found on the stems of more normal plants.) Grout (1906) described such a specimen from Georgia as the var. *taylorae;* in the type the costa is variable in length but never "nearly percurrent," as Grout said, and the plants are not at all similar to *A. cubensis* (Sull.) Mitt., as he suspected. The latter is much smaller and has leaves costate very nearly to the apex, and its leaf cells are much smaller. The var. *taylorae* is at best a weak segregate from a variable species, and I feel that it is merely an ecological form not at all worthy of recognition.

Some incidental notes on *Anacamptodon* elsewhere in the Americas may be included here. In the type collection of *A. cubensis* the leaves show considerable variation from lanceolate to ovate-lanceolate. In the Bolivian specimen (*Williams* 1944) the leaves are somewhat more ovate, but in both of Spruce's South American collections (northern Peru, no. 1369b, and San Carlos on the Río Negro, probably in Venezuela, no. 1369) the leaves

are narrower than in the type. All these specimens have the same general size and appearance; the setae are about 3.5-4.5 mm. long and the capsules about 1 mm. long; the leaves are about 0.6-0.9 mm. in length, costate very nearly to the tip, and their cells are small and thin-walled as compared with those of *A. splachnoides*. Further collections will be necessary to demonstrate the range of variation in *A. cubensis* and to prove conclusively that all the specimens mentioned above actually belong in the same species. In any case, *A. cubensis* and *A. splachnoides* are not particularly close in relationship.

It is interesting to note that Dr. A. J. Sharp collected several specimens of *Anacamptodon* in central Mexico. These plants are closely related to *A. splachnoides* but probably deserve description as a new species. They provide, however, another interesting example of the phytogeographic relationship of the Appalachian and Mexican temperate floras.

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NEW SPECIES OF ASTERELLA AND RICCIA FROM STO. DOMINGO AND CUBA

SIGFRID ARNELL[1]

Asterella dominicensis n. sp.[2] Monoicous. Thallus pale green, 20 mm. long, 5 mm. broad, thin and flaccid; margin undulate; ventral surface pale green; central vein pale brown ventrally; branching usually ventral. Ventral scales small, concave, purple, forming a proximally open pocket; no appendage observed. Dorsal epidermal cells 30 × 30-40 40 μ, walls thin, no trigones. Pores

[1] Centrallasarettet, Gävle, Sweden.

[2] Monoica, mediocris. Frons ad 20 mm. longa, 5 mm. lata, ex apice innovata, plana, margine crispulo-plicatulo; costa tenuis, postice dilute brunnea. Stomata magna, poro 8 cellulis triseriatis circumdato vel parva, 8-6 cellulis uniseriatis circumdato. Cellulae epidermidis tenerae, trigonis nullis. Pedunculus ad 35 mm. longus, dilute brunneus, apice longe barbatus. Carpocephala e centro hemisphaerico, ± papulosa, quadriloba, lobis oblique patulis attenuatis, apice rotundato vel emarginato. Pseudoperianthia hyalina. Sporae 100-120 μ, flavae. Elateres 6 × 250-300 μ, bispiri, spiris angustis. Androecia in ramulis parvis posticis.

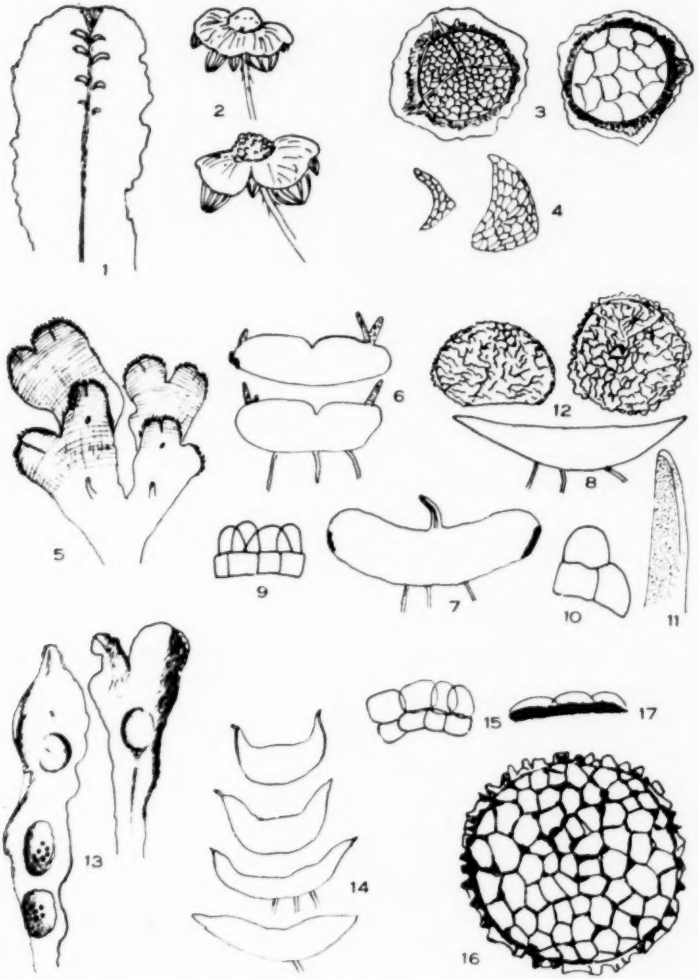

FIG. 1-4. *Asterella dominicensis*. 1. Thallus in ventral view. 2. Carpocephala. 3. Spores. 4. Ventral scales. FIG. 5-12. *Riccia cubensis*. 5. Male plant in dorsal view. 6. Cross-sections of the apical portion of a branch. 7. Cross-section of the midportion of a thallus. 8. Cross-section of the oldest part of a thallus. 9. Epithelial cells from the apex of a branch. 10. Scale. 11. Trichome. 12. Spores. FIG. 13-17. *Riccia ekmanii*. 13. Thalli in dorsal view. 14. Cross-sections of thallus. 15. Epithelial cells. 16. Spores. 17. Ventral scales.

generally surrounded by 8 radiating rows of 3 cells each, but also pores surrounded by one single row of 6-8 cells are observed. Male branches ventral, small. Female receptacle stalked, born from the dorsal surface, up to 35 mm. long, pale brown, with a few hyaline scales in the uppermost part. Disk hemispheric, smooth or generally with low tubercles, normally 4-lobed; lobes large; margin entire or somewhat incised. Pseudoperianth hyaline; segments connate at the tops. Elaters 6 × 250-300 μ, tortuous, yellow, bispirate. Spores 100-120 μ, yellow; convex face ± regularly areolate by cracks, areolae 12-20 μ wide; wing 8-12 μ wide; margin irregularly crenulate. (Fig. 1-4.)

HISPANIOLA: SANTO DOMINGO, Cordillera Central, prov. de Azua, San Juan, Lomas de la Mediana, Sabana Nueva, edge of brook, ca. 1950 m.s.m., *E. L. Ekman* 13584 (TYPE in Naturhistoriska Riksmuseum, Stockholm).

Riccia cubensis n. sp.[3] Dioicous. Thallus pale bluish-green, repeatedly dichotomously branched, up to 7 mm. long, 1 mm. broad; dorsal face of the old parts flat—slightly concave. Apex of the branches rounded, with a distinct furrow; margins with trichomes up to 90 μ long arising from the dorsal portion of the margin, small purple scales from the ventral part of the sides, margins frequently dark purple. Cross-section of the apical portion of the branches with a sharp midfurrow, margins rounded, breadth 3-4 times the height; cross-section of the midportion with rounded margins, breadth 4-5 times the height; in the old parts margins are acute. Epithelium in one layer, soon destroyed, cells hemispherical—semi-elliptical. Ventral scales small, purple, soon destroyed. Antheridia in the dorsal face, usually in the midline, neck colorless, up to 130 μ long. Archegonia in the midline, neck short, colorless. Spores very dark brown, 80-90 μ in diameter, margin with incomplete, irregularly papillose wing, convex face with irregular lamellae. (FIG. 5-12.)

Differs from *Riccia californica* Aust. by the flat dorsal face of the thallus and the pattern of the spores.

CUBA: Prov. Oriente, Sierra Maestra, Daiquirí, in thickets on coral reef, on naked earth, *E. L. Ekman* 8348 (TYPE in Naturhistoriska Riksmuseum, Stockholm). Prov. Santiago de Cuba, in dry limestone cliffs at Aguadores, on the ground, *Ekman* 8701. Prov. Habana, prope Morro, loco sicco, *Ekman* 1155.

[3] Dioica, mediocris, dilute glauco-viridis, calcicola. Frons ad 7 mm. longa, 1 mm. lata, plana—leviter concava, repetito furcata, furcis ½ mm. latis, apice rotundato, antico profunde canaliculato, margine breviter ciliato. Frondis adultis sectio transversalis 4-5plo latior quam alta, ubique aequicrassa, facie antica postica subparallela. Squamae posticae parvae, evanidae, purpureae. Ostiola mascula prominentia, non colorata. Ostiola femina breviter prominentia. Sporae 80-90 μ, irregulariter lamellatae, nigrae, anguste marginatae, margine creberrime papillata.

Riccia ekmanii n. sp.[4] Monoicous. Thallus up to 10 mm. long, 0.5-1 mm. broad, dichotomously branched; apex of the branches rounded. Dorsal surface pale green, concave. Margins acute. Cross-section lunate, sides slightly arched, generally almost perpendicular to the substrate, colorless—dark purple. Ventral scales slightly or not exceeding the margin of the thallus, imbricate, free margin rounded, entire, hyaline, basal portions connate and often colored purple. Ventral face convex, rhizoids very long. Epithelium thin-walled, in two layers, surface cells cubic or hemi-ellipsoidal. Archegonia in the midline, neck dark purple, of medium length. Spores 100-120 μ, almost black, wing incomplete, low, with low papillae; convex face regularly areolate, areolae about 12 μ in diameter, ridges ± thin, papillae in the corners. Male organs with hyaline neck. (FIG. 13-17.)

CUBA: Prov. Oriente, Daiquirí, on the coral reef, exposed to salt water spray, *E. L. Ekman* 8432 (TYPE in Naturhistoriska Riksmuseum, Stockholm).

FRULLANIA LONGICOLLIS

LOIS CLARK[1]

FRULLANIA LONGICOLLIS Lindenb. & Gottsche *in* G. L. & N. Syn. Hep. 783. 1847. Plants creeping, large, brown or yellowish-brown. Leafy stem to 1 mm. wide; stems to 9 cm. long, irregularly pinnate; primary branches mostly about 4.5 mm. long or a few to 35 mm. long, 5-9 leaves apart on a same side of stem, these are again sparsely pinnate or very rarely bipinnate; branches at tips attenuate, often ending in a small-leaved flagellum. Leaves closely imbricate, unequally bilobed. Dorsal lobe obliquely spreading, concave, when dry more or less closely wrapped about stem, obovate, asymmetric, 0.639-1.03 mm. long from middle of attachment to apex, 630-781 μ wide; dorsal base crossing stem to stem-width beyond; apex broadly revolute, decurved, apiculate; margin entire, recurved, dorsal base auriculate; auricle circinate. Cells of the dorsal lobe more or less in rows, fanning out from base; upper

[4] Monoica. Frons usque ad 10 mm. longa, bifurca, canaliculata anguste lanceolata—linearis, apice rotundato, sulco antica ± profunda. Squamae posticae parvae, ± purpureae, margine hyalino, marginem haud superantes. Sporae 100-120 μ, reticulatim lamellatae, foveolis 12 μ, alte papillatae.

[1] University of Washington, Seattle, Wash. This work was made possible by a grant from the Biological and Medical Research Fund of the State of Washington.

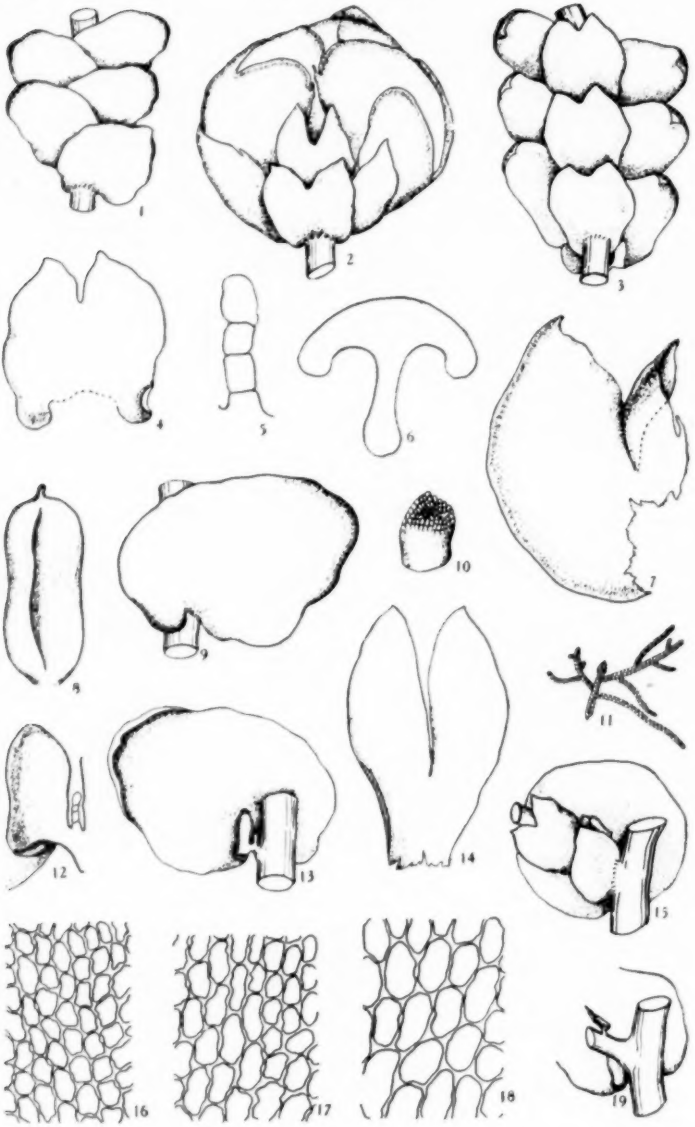

FIG. 1-19. *Frullania longicollis*. 1. Part of plant, dorsal view, × 17. 2. Male inflorescence, × 49. 3. Part of plant, ventral view, × 26. 4. Un-

marginal about 17 by 14 μ, median about 15 by 18 μ, basal 34-46 by 17-20 μ; walls thick, flexuous; trigones large, evident, triangular, often confluent; intermediate thickenings frequently present. Ventral lobe close to stem and parallel with it, saccate or very rarely explanate, 2-3 times as long as wide, 213-383 by 106-213 μ, not extending beyond basal margin of dorsal lobe; rounded at top, narrowing toward mouth; mouth flaring, almost truncate; explanate ventral lobes when present intermingled with saccate lobes, lanceolate, acute. Leaf subtending branch larger than adjacent stem leaves, symmetric, obovate to rounded, 710 μ long, 953 μ wide; apex rounded; margin entire, revolute; both bases somewhat auriculate; ventral lobe saccate. First leaf of branch represented by 2 saccate lobes or rarely one of them explanate. Underleaves of stem large, 3 times as wide as stem, ovate-oblong, 426-566 μ long from point of attachment to apex, 560-615 μ wide, bilobed 1/6-1/4 leaf length; sinus obtuse to right-angled or narrower at base; lobes triangular, acute to obtuse; margins entire, revolute; bases appendiculate; auricles more or less canaliculate. First underleaf of a branch either obovate and bilobed with round lobes, or ovate and unlobed with rounded apex. Stylus a single row of 4-5 cells; end cell hyaline. Plants unisexual. Male inflorescence on a short lateral branch, capitate. Male bracts 5-9 pairs, slightly unequally bilobed, very concave; apices rounded; margins entire except for a tooth (stylus) on ventral margin; at base of ventral lobe papillae may occur, with end cell 2-3 times the length of adjacent one. Female inflorescence on main stem or branch, bracts larger than leaves, unequally bilobed for 1/3-1/2 leaf length. Dorsal lobe ovate, 1.75-2.2 by 0.93-1.07 mm.; apex acute; margin reflexed, entire or denticulate. Ventral lobe ovate, about 1/2 as wide as the dorsal, shorter, 1.2-1.56 mm. by 360-570 μ; apex attenuate, acute to setaceous; margins reflexed, the adaxial one entire or with 1-3 laciniae, the largest lacinia the stylus; abaxial margin entire, reflexed. Female bracteole free or united at base with one bract, obovate-oblong, closely enclosing ventral keel of perianth, approximately 1.6 mm. long and 1.2 mm. wide, very brittle, upper portion frequently broken off. Perianth 1/3-emergent, oblong, 2.6-3.33 mm. long, 800-900 μ wide; 3-keeled, rounded to beak; beak curved, about 249-284 μ long and 116-127 μ wide.

derleaf, × 42. 5. Stylus, × 267. 6. Cross-section of perianth, × 49. 7. Female bract, × 27. 8. Perianth, × 9. Leaf, dorsal view, × 49. 10. Tip of beak of perianth, × 58. 11. Part of plant, × 1. 12. Ventral leaf lobe, × 88. 13. Leaf, ventral view, × 49. 14. Female bracteole, × 20. 15. Base of branch, × 49. 16. Cells near leaf tip, × 267. 17. Cells of leaf middle, × 267. 18. Cells near leaf base, × 267. 19. Base of branch, × 49. (All drawings from *Brenez* 9110, by Janet Fukuda.)

HABITAT: creeping on trees.

TYPE LOCALITY: Mexico.

SPECIMENS EXAMINED: Costa Rica, Collines de Pudales, San Ramón, *Aman Brenez* 9410, June 1900. Argentina, no locality, *Robt. E. Fries* 40, July 1, 1901. Material kindly lent by Farlow Herbarium of Harvard University.

RANGE: Costa Rica, Mexico, Andes of Peru, Argentina.

Frullania longicollis and *Frullania cucullata* in sterile condition are distinguished with difficulty. *F. cucullata* is a smaller plant with decurved branches; ventral lobes mostly explanate; apices of explanate ventral lobes and those of underleaves cucullate; underleaves smaller, bases not decurrent; female bracts smaller than leaves, margins entire; beak of perianth straight and short.

Frullania intumescens resembles *Frullania longicollis* in some points but differs in many important ways: At the branch tips *F. intumescens* has many short branches, giving the plant a bunchy, swollen appearance which is lacking in *F. longicollis;* in *F. intumescens* the ventral lobes of the stem leaves are often cucullate, but in *F. longicollis* not so; the perianth of *F. intumescens* is terete at base, 3-angled in the upper part, whereas the perianth of *F. longicollis* is 3-angled throughout; the beak of the perianth of *F. intumescens* is straight, while that of *F. longicollis* is slightly curved.

FRULLANIA BREUTELIANA

LOIS CLARK[1]

FRULLANIA BREUTELIANA Gottsche *in* G. L. & N. Syn. Hep. 461. 1845. Plants of medium size, pale brown to yellowish-brown, somewhat flaccid, leafy shoot to 1.5 mm. wide. Stem brown, to 10 cm. long, 70-106 μ in diameter, regularly bipinnate; primary pinnae 5-9 leaves apart on same side of stem, 1-1.7 cm. long; secondary pinnae few, with tapering ends. Cross-section of stem with cells all about the same size, mostly 6-sided; cortex of 2 layers of cells, very dark brown; interior cells white or light-colored. Stem leaves contiguous to distant, erect-spreading, decurved, unequally bilobed. Dorsal lobe oblong-ovate, 0.88-1.4 mm. long, 570-600 μ wide, acute to acuminate, margin entire or somewhat sinuate near apex, ventral margin slightly inflexed near base, dorsal margin crossing stem up to half stem-width beyond, dorsal

[1] University of Washington, Seattle, Wash. This work made possible by a grant from the Biological and Medical Research Fund of the State of Washington.

base auriculate, auricle longer than wide. Ventral lobe saccate or on some branches or female plants explanate. Saccate ventral lobe about ⅓ stem-width from stem and parallel with it, oblong-cylindric, about 3-4 times as long as wide, about 270 by 71 μ, slightly constricted above narrow mouth, not or little extending below lower margin of dorsal lobe, apex rounded. Explanate ventral lobes lanceolate, 4-5 times as long as wide, acuminate. Stylus a single row of 3-5 cells. Leaf subtending branch larger than stem leaf, nearly symmetric, subrotund, about 735 by 700 μ, acute and apiculate, base auriculate, dorsal auricle slightly the larger; ventral lobe saccate or explanate. First leaf of branch with 2 saccate or 2 explanate lobes. Cells of stem leaf near apex about 20 by 10 μ, of middle about 26 by 12 μ, of base 34 by 12 μ, walls thick and flexuous; trigones wanting to distinct; intermediate thickenings absent throughout. Underleaves of stem 2-3 times as wide as stem, decurved-concave, transversely inserted, ovate to oblong-ovate, 425-535 by 282-511 μ, ⅓-bilobed, sinus acute; lobes narrowly triangular, acute; margins entire, reflexed throughout (but not those of branch leaves); bases sagittate, auricles somewhat canaliculate. First underleaf of branch triangular-ligulate, not 2-lobed, margin plane and entire. Plants unisexual. Male inflorescence not seen. Female inflorescence terminal on short branch. Female bracts young, larger than stem leaves, ⅕ bilobed, dorsal lobe oblong-ovate, about 960 by 430 μ, narrowed to acuminate apex, inner margin entire to sinuate, outer margin with 3 wide tooth-like sinuations in the middle region. Ventral lobe narrower than dorsal one, slightly shorter, closely canaliculate, adaxial margin with a subulate basal tooth and 2 large teeth also in the lower part. Female bracteole oblong, ⅔-bilobed; lobes again bilobed or with a large subulate tooth on either side, otherwise entire or dentate; apices canaliculate, basal margin reflexed. Perianth unknown.

HABITAT: on trees.

RANGE: tropical America.

SPECIMENS: West Indies: St. Kitts, *Breutel* (packet marked "TYPUS"); also *L. Holm* 9996. Both kindly lent by Farlow Herbarium of Harvard University.

Frullania breuteliana closely resembles *Frullania beyrichiana* in having ultimate pinnae tapering, margin of underleaf revolute throughout and female bracteole 4-parted. It differs in having the branches more gradually tapering and longer, leaf with acuminate point and most margins reflexed, the auricles rarely plane, mostly canaliculate and bracts and bracteole toothed. *F. beyrichiana* has its leaf apiculate, margin entire, slightly recurved and the auricles plane and rarely canaliculate.

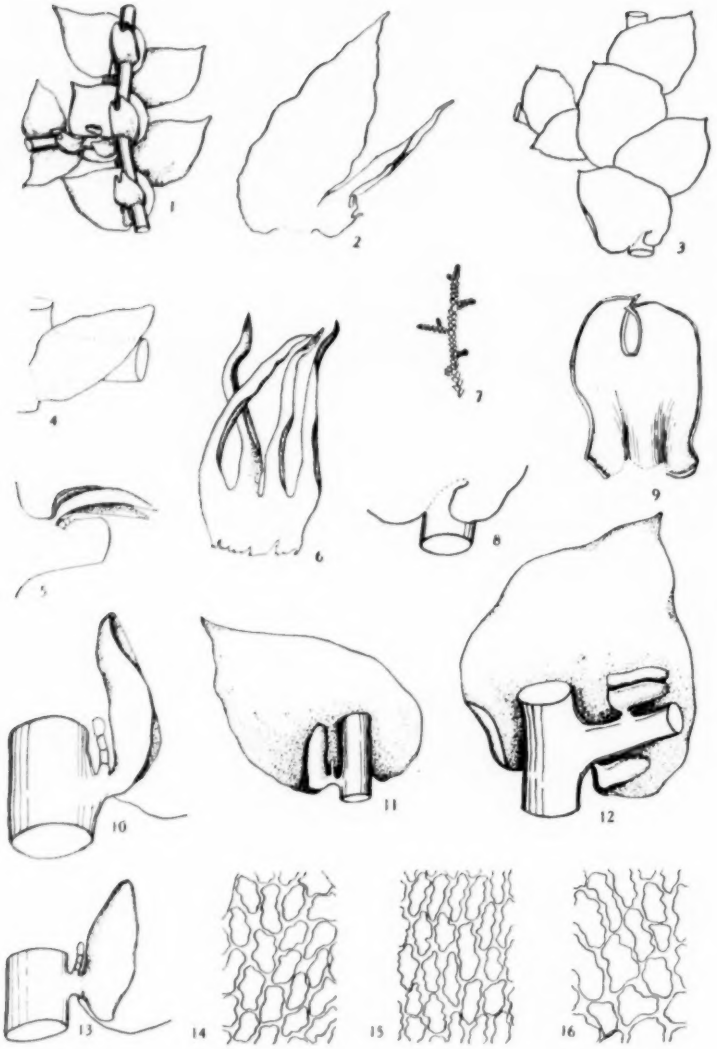

FIG. 1-16. *Frullania brunteliana*. 1. Part of plant, ventral view, × 15. 2. Female bract, × 34. 3. Part of plant, dorsal view, × 15. 4. First underleaf of branch, × 58. 5. First leaf of branch, both lobes explanate, × 58. 6. Female bracteole, × 34. 7. Part of plant, × 1. 8. Base of dorsal leaf lobe, × 58. 9. Underleaf, × 58. 10. Explanate ventral lobe of stem leaf, × 73

Until the mature perianths of both species are found, compared and described, it seems best to recognize both species.

Unfortunately only one female inflorescence was found, and that an immature one, leaving in question the amount of union, if any, of female bracteole with the adjacent bracts.

FRULLANIA DUBIA[1]

LOIS CLARK[2]

FRULLANIA DUBIA Lindenberg & Hampe, Linnaea 24: 641. 1851. Plants creeping, medium in size, rigid, brownish-green. Stem to 4 cm. long. Leafy stem 1 mm. wide, regularly bipinnate; primary branches on same side of stem 4-7 leaves apart, about 4 mm. long, somewhat decurved; pinnae remote, ultimate pinnae somewhat tapering with apices more or less quadrate. Stem brown, about 156 μ in diameter, cells in cross-section round or hexagonal, of equal size throughout; cortex of one row of cells, brown, walls thicker than those of inner cells. Leaves imbricate, unequally bilobed. Dorsal lobe of stem leaf obliquely spreading, asymmetric, obovate-oblong, 760-852 μ long, 532-675 μ wide; apex strongly decurved, acute to subobtuse and apiculate; dorsal margin crossing 1-1.5 times the stem width beyond; margin entire; dorsal margin appendiculate; auricula large, circinate. Ventral lobe of stem leaf saccate, or explanate and cucullate, erect. Saccate lobe cylindric, close to stem and parallel, twice as long as wide, 177-213 by 85-107 μ, slightly constricted near mouth; mouth extending somewhat below basal margin of dorsal lobe; apex rounded. Explanate ventral lobe of stem leaf often mingled with saccate lobes, 213-249 by 71-85 μ; apices acute or obtuse, cucullate. Stylus of a single row of 4-5 cells. Leaf subtending a branch larger than stem leaves, symmetric, subrotund, circinately appendiculate on both sides, dorsal auricle the larger, its ventral lobe either saccate or explanate. Upper marginal cells of dorsal lobe subquadrate, 15-17 by 10-14 μ, with rather thick walls; median cells averaging

[1] This work was made possible by a grant from the Biological and Medical Research Fund of the State of Washington.

[2] University of Washington, Seattle, Wash.

11. Stem leaf, ventral view, × 34. 12. Leaf subtending branch, first leaf of branch with both lobes saccate, × 58. 13. Explanate ventral lobe of leaf, × 65. 14. Cells near leaf tip, × 266. 15. Cells of leaf middle, × 266. 16. Cells near leaf base, × 266. (All drawings from *Holm* 9996; fig. 1-5, 7, 9, 14-16 by Bertha Pitcher; fig. 6, 8, 10-13 by Janet Fukuda.)

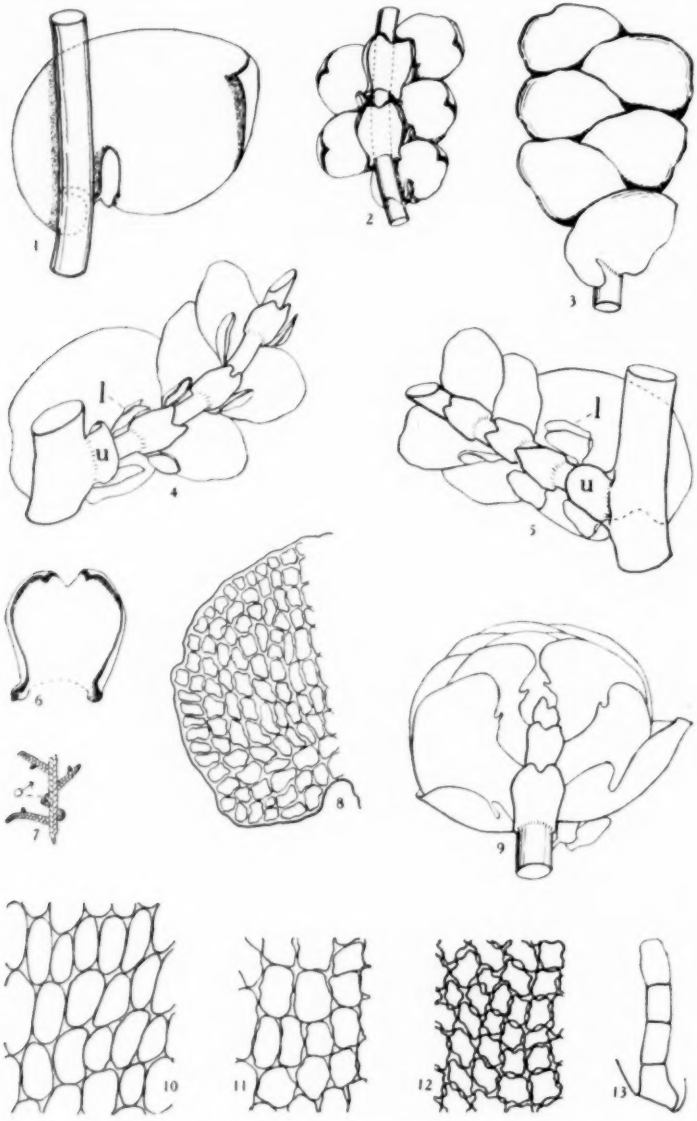

FIG. 1-13. *Frullania dubia*. 1. Stem leaf, ventral view, × 50. 2. Part of stem, ventral view, × 20. 3. Part of stem, dorsal view, × 20. 4-5.

22 by 14 μ; basal cells 26-31 by 14-19 μ, large basal cells often extending into auricle: walls thick and flexuous throughout upper portion: trigones large; intermediate thickenings sometimes present in apical region; cells of circinate appendage of dorsal lobe in radiate rows, walls thick. First underleaf of branch entire, ovate. Underleaves of the stem transversely inserted, large, about 3 times as wide as stem, subrotund to obovate, 696-957 by 357-536 μ, 1/8-1/4 bilobed, lobes acute to subobtuse, sinus right-angled to obtuse; margins entire, revolute; base appendiculate, sagittate; underleaves of branches smaller, ovate. Plants unisexual. Male inflorescence on short lateral branch, globose or capitate, of 4-5 pairs of bracts; male bracts nearly equally bilobed, ventral lobes the smaller; apices acute, margins entire except for a large tooth (stylus) on ventral lobe; underleaf of male branch at base of male inflorescence bilobed; male bracteoles smaller, unequally bilobed, apices of lobes rounded. Female inflorescence not seen.

TYPE: Costa Rica.

HABITAT: Creeping on trees.

SPECIMEN EXAMINED: *Costa Rica:* Forêt de Barba, *H. Pittier 2325*, Jan. 10, 1890, in Farlow Herbarium of Harvard University.

RANGE: Costa Rica, Mexico, Venezuela.

Frullania dubia in sterile condition resembles *Frullania brasiliensis* very closely in color, habitat and shape of dorsal lobe of stem leaf. It differs in having the apices of the dorsal leaves acute and apiculate; thick and flexuous cell walls in the upper leaf cells; the lower third of the underleaves not clasping the stem but free; wider sinuses of the underleaves.

If the description of the female bracts, bracteole and perianth by Lindenberg and Hampe and by Stephani is correct, *F. dubia* separates at once from *F. brasiliensis*, since *F. brasiliensis* has a terete perianth tapering to a long beak, while *F. dubia* has a perianth at least 3-angled.

The female reproductive parts are described by Lindenberg and Hampe in Linnaea 24: 641. 1851, and by Stephani in his *Species Hepaticarum* 4: 494. 1911, as follows: female bracts 3 times as long as leaves, ovate from a narrow base, apiculate; sinus extending 2/3 down; ventral lobe as long as dorsal, lanceolate, acute, entire. Female bracteole subrotund; margin recurved, subdentate; apex 2-lobed to 2/3 down, sinus narrow; lobes oblong, apiculate. Perianth 3-angled, oblong, smooth, exserted.

Branch, (*u*) first underleaf, (*l*) first leaf, × 50. 6. Underleaf, × 40. 7. Part of plant, × 1. 8. Leaf auricle, × 228. 9. Male inflorescence, ventral view, × 50. 10. Cells of leaf base, × 267. 11. Cells of leaf middle, × 267. 12. Cells of leaf apex, × 267. 13. Stylus, × 267. (All drawings from *Pittier 2325* by Janet Fukuda.)

HEPATICAE COLLECTED BY SVIHLA NEAR SEWARD AND FAIRBANKS, ALASKA[1]

LOIS CLARK[2]

The material was gathered by Dr. Ruth D. Svihla during the summer of 1954. The Seward collection was made about 15 miles north of the city along the highway to Anchorage, on August 16, and will be designated merely as Seward. In the Fairbanks region material was gathered from several localities. It seems desirable that the records be preserved since probably soon someone will write a preliminary hepatic flora of Alaska. The collection is in the herbarium of the University of Washington.

CALYPOGEIA NEESIANA (Massal. & Carest.) K. M. Seward (1654a, 1656).

CEPHALOZIA LAMMERSIANA (Hueb.) Spruce. Seward, intermingled with *Pohlia cruda* (4111).

CEPHALOZIA LEUCANTHA Spruce. Seward (1654a).

CEPHALOZIA MEDIA Lindb. Seward (1657) and intermingled with *Dicranum fuscescens* (4120); near Fairbanks, north of Fox, Aug. 13 (1650).

CEPHALOZIELLA BYSSACEA (Thed.) Buch. About 30 mi. SE. of Fairbanks, along the Alcan Highway, Harding Lake, Aug. 14 (1652).

CEPHALOZIELLA HAMPEANA (Web.) Hampe. Seward (1662).

CHILOSCHYPHUS POLYANTHUS (L.) Corda. Seward (1669a).

GYROTHYRA UNDERWOODIANA Howe. Seward, intermingled with *Pohlia cruda* (4111). This is known from southeastern Alaska (Evans, Bull. Torr. Bot. Club 41: 587. 1914) and from Prince William Sound (Eyerdam, THE BRYOLOGIST 55: 31. 1952). It is not likely that this is the western limit of its range.

JUNGERMANNIA CORDIFOLIA Hook. Seward (1655a).

LEIOCOLEA HETEROCOLPA (Thed.) Buch. About 30 mi. SE. of Fairbanks, along the Alcan Highway, Harding Lake, Aug. 14 (1652).

LOPHOZIA INCISA (Schrad.) Dum. Seward (1657).

LOPHOZIA PORPHYROLEUCA (Nees) Schiffn. Seward (1658).

LOPHOZIA VENTRICOSA (Dicks.) Dum. Seward (1654, 1656, 1657, 1659, 1662, 4120).

MARCHANTIA POLYMORPHA L. About 40 mi. SE. of Fairbanks, along the Alcan Highway, Birch Lake, Aug. 12 (1649).

NARDIA GEOSCYPHA (DeNot.) Lindb. Seward (1654).

NARDIA SCALARIS (Schrad.) S. F. Gray. Seward (1657).

PTILIDIUM CALIFORNICUM (Aust.) Underw. & Cook. Seward (1663).

PTILIDIUM PULCHERRIMUM (Web.) Hampe. Seward (1659-1662, 1664-1666); about 30 mi. SE. of Fairbanks, along the Alcan Highway, Harding Lake, Aug. 14 (1653).

RICCARDIA PINGUIS (L.) S. F. Gray. Seward (1669); Fairbanks, north of Fox, Aug. 13 (1651).

SCAPANIA IRRIGUA (Nees) Dum. Fairbanks, north of Fox, Aug. 13 (1650).

[1] This work was made possible by a grant from the Biological and Medical Research Fund of the State of Washington.

[2] University of Washington, Seattle, Wash.

On the way to Alaska, along the Alcan Highway on August 9, at Whirlpool Rapids, British Columbia, about Lat. 59° 35′ N., Long. 124° W., Svihla gathered *Bucegia romanica* Radian (1647). This extends the range at least 500 miles farther north in North America than before known to us. It may now be reasonably expected in Yukon and Alaska.

ON ANAPTYCHIA LEUCOMELAENA FO. FILIFORMIS

W. L. Dix[1]

When I recently described *Anaptychia leucomelaena* fo. *filiformis*, I had only a single specimen. Since that time more material has come to my attention and confirms my description with slight modifications. Very recently on looking over an account of lichen collecting in Jamaica I found that C. C. Plitt had reported a collection of *Oropogon loxensis* from there. I was suspicious of this determination as Wm. Seifriz, who had collected my material, was with Plitt. Through the kindness of Dr. J. A. Stevenson of the Plant Industry Station in Beltsville, Maryland, I was allowed to examine Plitt's specimen. The material is the same as that collected by Seifriz, with the same collecting data and habitat on the ground among mosses, as I had reported in my account of this form. It is not *Oropogon loxensis* but *Anaptychia leucomelaena* fo. *filiformis*.

I reported the material as "terricola." Although there was ample evidence for such a description, it appears from later collections that it may also be "a pendent epiphyte" in Jamaica (*Proctor* 4225, 4345, 4359) and grows "on bushes and trees" in Peru (*Pennell* 15709). Pennell also collected in Peru a fertile specimen of *Oropogon loxensis* which presented a good opportunity to observe the differences between the two genera. I described this form as terete, not bifacial, in order to separate it from *A. leucomelaena* var. *multifida* fo. *circinalis* A. Zahlbr., fo. *crinalis* A. Zahlbr. and var. *multifida* Wainio, all of which are bifacial. The white thallus is for the most part cylindrical even under the microscope. In some places, however, especially on the darker parts of the thallus, there appears a light channel-like line, and in a cross-section there is an evident break in the cellular structure on one side, apparently the juncture of the inflexed cortex.

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THE MEETINGS OF THE BRITISH BRYOLOGICAL SOCIETY, 1957

A. C. CRUNDWELL[1]

The Society met at Barnstaple, Devonshire, from 24 to 29 April, for excursions and for the annual business meeting. The north Devon coast is so varied and so attractive, both scenically and botanically, that most of the time was spent upon the cliffs and the dunes, with one excursion to a wooded river valley inland. There were no startling discoveries, the best of the plants new to north Devon being *Fissidens monguilloni* and *Bryum erythrocarpum* var. *hegelmaieri*, but the species seen included many that are rare in Britain, such as *Barbula cordata*, *Philonotis rigida*, *Petalophyllum ralfsii* and *Porella pinnata*.

The summer meeting was held in the west of Ireland during the last fortnight of August. Galway City was headquarters for the first week, most of which was devoted to the limestone areas of counties Clare and Galway. Of special interest here were the "turloughs," depressions in the limestone up to a mile across, fed by underground channels and subject to violent fluctuations in water level. Large *Crataegus* bushes were smothered with luxuriant *Cinclidotus fontinaloides*, and this and *Leskea polycarpa* grew high upon the tree trunks. Among the more interesting new records made on the limestone were *Seligeria doniana*, *Amblyodon dealbatus*, *Anomobryum concinnatum* and *Physcomitrella patens*. *Ulota vittata* was seen in great abundance on hazels. A whistlestop by the sea yielded a scrap of *Bryum salinum*. This was the only species new to Ireland found during the meeting, though four more were found at other times during the year: *Tortula subulata* var. *graeffii*, *Bryum neodamense*, *Camptothecium nitens* and *Meesia tristicha*, the last being new to the British Isles.

A day on Maumtrasna, a mountain in county Mayo, introduced members unfamiliar with them to *Herberta hutchinsiae*, *Colura calyptrifolia*, and others of the oceanic hepatics so characteristic of Ireland. Noteworthy additions to the flora of the county included *Sphagnum strictum*, *Campylopus setifolius*, *Bryum mildeanum* and *Trichostomum hibernicum*.

The second week was spent in Connemara, a sparsely populated land of bogs and mountains, one of the three main centres in Ireland for oceanic species, but one less rich and much less thoroughly investigated than the counties of Kerry and Cork in the extreme southwest. Of species previously known in Ireland

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only from the southwest, three were found in Connemara: the lichen *Sticta sinuosa*, the moss *Leptodontium recurvifolium* and the hepatic *Teleranea nematodes*, this last being found there by P. W. Richards just after the meeting was over. Among the more interesting of the other species new to Connemara were *Bazzania pearsoni*, *Mastigophora woodsii*, *Dicranodontium uncinatum*, *Grimmia retracta* and *Mnium orthorrhynchum*. The scarcity of wooded ravines probably accounts for the failure to find such species as *Plagiochila tridenticulata*, *Radula carringtoni* and *Sematophyllum* spp., all of which are to be expected there.

Those taking part in this enjoyable fortnight were lucky with the weather, and the magnitude of the contribution made to our knowledge of the Irish bryophyte flora affords a striking demonstration of the very large amount of work that still remains to be done there.

THE 1957 FORAYS OF THE AMERICAN BRYOLOGICAL SOCIETY ON THE SANTA CRUZ PENINSULA, CALIFORNIA

JOHN W. THOMSON[1] and EDWIN H. KETCHLEDGE[2]

The unique character of the California flora and vegetation made the 1957 forays of exceptional interest. With such exceedingly diverse habitats available within a distance of a few miles, the members of the Society were treated to a rare experience in field collecting. The rich experience of the leaders in the local flora also made for an outstanding opportunity. This year an unusual arrangement of joint leadership on the forays gave the members a remarkably broad survey of the California flora. We are deeply indebted to Drs. Herman Persson and W. C. Steere of Stanford University leading the trips for the mosses and hepatics and Dr. Albert W. Herre of Santa Cruz, California, leading the group for lichens.

On the morning of Friday, August 23, the group met early and all drove together to Devil's Canyon on the Fatjo Ranch, Santa Clara County, up in the hills of the Santa Cruz Range. After parking the cars in the yard of the owner, they wandered through an old walnut grove on the top of a dry ridge. Here were collected *Physcia aipolia*, *P. adscendens*, *Sticta anthraspis*, *Buellia parasema* and other lichens on the walnuts. The most

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conspicuous moss was *Orthotrichum lyellii*, which covered bark and branches with luxuriant mats of green. *Tortula laevipila* was collected in good fruit at the base of the trees and *T. princeps* on the ground around the trees.

At the top of the ridge were a few old oaks. On these were collected *Physcia grisea*, *Nephroma lusitanicum* and various Parmelias. The semi-ubiquitous *Homalothecium nuttallii* was everywhere abundant. Several patches of *Fabronia pusilla* were located on the live oaks, as well as a few fruiting specimens of *Radula bolanderi*.

The party separated into two groups at this point, with the bryologists proceeding down the slope into a wooded ravine and the lichenologists remaining at the top of the ridge near a sharp break with the sclerophyllous shrubs of the chaparral. On the shrubs were a number of epiphytic lichens including quite a variety of Usneas: *U. arizonica*, *U. glabrata*, *U. dasypoga* and *U. comosa*. A group of shrubs was covered with an abundance of the black thalli of *Cornicularia californica* and a little down the hill a manzanita bore quantities of large tufts of *Parmelia enteromorpha*. On a large boulder in the chaparral was found enough *Rhizocarpon bolanderi* for all who wished it to make a collection. A larger outcrop yielded *Physcia callosa*, *Sticta anthraspis* and its sorediate form which has been named *Pseudocyphellaria anomala* and *Ramalina farinacea* on the shadier parts. In the sun on the rock outcrop were found *Parmelia disjuncta*, *Lecidea auriculata*, *Cyphelium bolanderi*, *Lecanora coilocarpa* and *Xanthoria candelaria*. A little lower down the steep slope a boulder was covered with mosses and intermingled thalli of *Leptogium californicum* with its very shiny lobe tips. As the group descended into the Douglas fir and madrone forest below they collected *Bacidia albescens* and an undescribed *Parmeliella* on the madrone and *Cetraria ciliaris* and *Lobaria pulmonaria* on the fir. The return to the cars led past a group of *Aesculus* bearing much *Xanthoria candelaria* and *Collema nigrescens*. *Parmelia olivacea* was also collected at this locality.

Meanwhile, the bryologists explored the douglas fir forest in the ravine and found a rich assortment of species. Especially conspicuous were the feathery stands of *Dendroalsia abietina* covering the trunks of trees; similarly, *Antitrichia californica*, *A. curtipendula* and *Alsia californica* formed dense corticolous mats. Two species appeared equally abundant on rocks and bark, *Pseudisothecium stoloniferum* and *Pterogonium gracile*. On the forest floor *Porella navicularis* was abundant. Along the stream bank several species were common, including *Scleropodium caespitans*,

Part of the 1957 Foray group at Stanford University. FRONT, LEFT TO RIGHT. E. H. Ketchledge, Sam Shushan, W. C. Steere, V. J. Krajina, H. N. Mozingo, J. W. Thomson. STANDING IN BACK. E. C. Ogden, Mrs. Betty Higinbotham, N. Higinbotham, Anne Stacy, Margaret Fulford, Dr. Herman Persson, Dorothy Stacy, G. T. Johnson, R. F. Cain, Seville Flowers, A. W. Herre. Also present but not in the picture were Dr. and Mrs. H. H. Holliger, John and Stefan Holliger, Mildred Bush, George Oberlander, M. M. Barr, Leah Reid, Mrs. V. J. Krajina, Peter Krajina and Paul Bedesem.

Porothamnium bigelovii and *Claopodium whippleanum;* on rocks in the stream *Orthotrichum rivulare* occurred sporadically. Among the other less-frequent species were *Orthotrichum bolanderi, Neckera douglasii, Camptothecium pinnatifidum* and an undescribed species of *Atrichum.*

During the afternoon the parties split, the lichenologists going to Castle Rock, Santa Clara County, and the bryologists crossing the valley to Mt. Hamilton east of San Jose in Santa Clara County.

At Castle Rock the lichenologists collected *Lecidea enteroleuca* and *Parmelia glabra* on the rocks and *Sticta anthraspis, Cetraria glauca, Cetraria herrei* (*C. tuckermanni*) and *Usnea cavernosa* on the trees. The best find was *Pannaria isidata* Degel. on the rocks, new to California.

At Alum Rock Park, at the foot of Mt. Hamilton, near the hot springs, the bryologists found a perplexing number of tortulaceous species, several of which are undescribed. One crumbling bank beside a trail supported scattered populations of a *Mielichhoferia* which Dr. Steere reports differs from any described species. Other species collected in the park included *Scleropodium californicum, Barbula vinealis, Orthotrichum tenellum* and *Eucladium verticillatum,* plus several species seen on the morning trip.

On the morning of Saturday, August 25, the parties met again at Jordan Hall but took separate trips on this day. The bryologists drove to Big Basin State Park. After visiting the museum at the park headquarters the party followed Dr. Steere and Dr. Persson through a magnificent stand of redwoods. Upon reaching a side trail in the park, members began collecting along the bank of a meandering stream. Most of the species collected the day before at Devil's Canyon were encountered again, and many new species seen. Dr. Steere pointed out the dimorphic nature of *Pseudisothecium stoloniferum* which varies depending upon whether the plants grow on the side of stumps or rocks, in which case the stems were greatly attenuated as if subject to a "drip-tip" effect, or whether the plants grew on a horizontal surface, there assuming a tufted form. Our leaders also noted the ecological restriction of *Aulacomnium androgynum* to the charcoal surface of burned stumps and logs. Several undisturbed logs and stumps displayed mats of *Hypnum circinale* interspersed with tufts of *Dicranum strictum,* and on one or two occasions *Zygodon viridissimus.* Scrambling along the stream, members collected loose intertangled masses of *Neckera douglasii* and *Neckeradelphus menziesii* hanging from branches and trunks; on the ground *Eurhynchium oreganum, Porothamnium bigelovii* and *Leucolepis menziesii* were abundant. Silty soil at the stream edge provided

curly tufts of *Dichodontium pellucidum* and thick clumps of *Mnium glabrescens*. One rock protruding above the water level supported dark green patches of *Blindia acuta*, while the same rock below the water exhibited clumps of *Fissidens rufulus*. Perhaps the most interesting find of the morning was a solid bank of *Pohlia longibracteata*. At noon the party returned to the park headquarters for lunch. The afternoon was spent in a leisurely trip home by way of the Felton redwood grove near Boulder Creek and the Skyline Drive along the crest of the Santa Cruz Mountains. Before leaving the mountains Dr. Steere had the opportunity to demonstrate the necessity of carrying a fifth tire in the trunk of a car.

On their trip the lichenologists stopped first at a locality on Searsville Ridge, four miles west of Stanford. The reason for the stop was a large stand of *Ephebe solida*, of which much material was collected. But other lichens were also collected here, including *Ramalina reticulata* in fruit, *R. ceruchis* fo. *cephalota*, *Cladonia verticillata* fo. *phyllophora*, *Parmelia andreana*, *P. dubia*, *Evernia prunastri*, *Physcia callosa*, *P. orbicularis*, *P. grisea* and *Leptogium californicum*.

From here the group drove over the range to Pilarcitos Creek Canyon, San Mateo County. Leaving the cars at the base of the steep slopes, the group headed up through a grove of *Eucalyptus* on which was *Lecanora varia* and a brilliant golden alga. On the shaded rock sides was a small stand of *Cladonia furcata* var. *pinnata*, *Parmelia olivaria* and *Alectoria jubata*. A fallen tree trunk had much *Parmelia reticulata* and *Anaptychia ciliaris*. The trail up the bottom of the steep-sided ravine disappeared, and the way up to the dry chaparral was blocked by a mass of densely tangled raspberries and other woody plants. Our youthful (!) leader unlimbered his machete and led the way, demonstrating how he had collected in the Philippines many years ago. It was an impressive performance. Once the drier chaparral was gained, the collecting became rich indeed. A rock outcrop was covered with several square yards of *Physcia callosa* in fruit and much of this rare species was collected for exchanges. On the shrubs of the chaparral were collected *Catillaria atropurpurea*, *Blastenia ferruginea*, *Collema nigrescens*, *Teloschistes chrysopthalmus*, *Catillaria glauconigrans*, *Usnea substerilis* and *Ramalina farinacea*. Some old weathered redwood fenceposts, by which the party helped themselves climb the steep ravine sides, proved very interesting in their flora. On them were *Calicium abietinum* (*C. curtum*), *Cyphelium occidentale*, *C. inquinans*, *Lecidea flexuosa*, *L. quernea*, *Lecanora varia*, *L. pallida*, *Buellia oidalea*, *Parmelia caperata* and *Anaptychia*

leucomelaena. A charred post yielded *Cladonia macilenta* fo. *styracella*. On the soil near the top was a little *Parmeliella lepidiota* var. *corallophora*, *Sticta limbata*, *Diploschistes scruposus* and *Cladonia chlorophaea*. A willow which was growing in the bottom of an old earthquake crack near the top of the hill had some *Parmelia olivacea* on the twigs. The open rocks at the top of the hill were covered with an incredible abundance of *Ramalina homalea* growing like a lawn on the dry rock surfaces. Tufts of *Teloschistes flavicans* in fruit were also collected in satisfactory quantity. On the barer rock surfaces were *Lecidea theioplaca*, *Rhizocarpon viridiatrum*, *Caloplaca bolacinum*, *Blastenia ferruginea* var. *bolanderi*, *Pertusaria rupestris*, *Sarcogyne californica* and *Parmelia saxatilis* var. *aizoni*. On the soil edges of the exposed rock were several of these same species and also *Parmelia sulcata*, *Sphaerophorus globosus* in unusual tiny tufts and *Parmelia arnoldii*. While the group was busy with packeting, our energetic leader climbed a nearby hill "just for the exercise." On his return he showed us a large stand of *Cladonia carassensis* fo. *subulata* growing on the earth over rocks a little below the summit. On the way down on the opposite side of the hill *Ramalina combeoides* was discovered under an overhang of the summit ledges. Near the bottom an old dead tree was covered with *Ramalina ceruchis* fo. *cephalota* and *R. menziesii*. A *Cupressus* added *Xanthoria polycarpa* and *Opegrapha prosilens* which were growing on the old cones. At this point an irate landowner gave Dr. Herre an interesting time explaining that he had obtained permission to bring the group on the Canyon sides, but the owner finally "softened" and told the group that they were welcome. As it was late afternoon the members of the group ate their lunches which had been left in the cars and then returned to Stanford University.

On Sunday, August 25, the trips were again joint and this time led by Dr. Persson. The trip was to Searsville Lake, San Mateo County. Here a rock hill of sandstone below the dam turned out to be exceedingly rich in variety of lichens. The sandstone was multicolored with reds and yellows and blacks of the thalli. Here were collected on the rocks the following lichens: *Acarospora rufescens*, *A. subalbida*, *Blastenia ferruginea* var. *bolanderi*, *Buellia badia*, *Caloplaca bolacinum*, *C. cinnabarina*, *Candelariella dispersa*, *Diploschistes actinostomus*, *D. scruposus*, *Lecanora (Aspicilia)* cf. *gibbosula*, *L. coilocarpa*, *L. laevata*, *Lecidea atrobrunnea*, *L. goniophila*, *L. theioplaca*, *L. platycarpa*, *Leptogium californicum*, *Parmelia conspersa*, *Physcia callosa*, *P. tribacoides*, *Placynthium dubium* Herre (this must be near the type locality), *Polychidium albociliatum*, *Rinodina confragosa*, *R.*

oreina (P-, C- strain), *Sarcogyne simplex*, *Thelidium microbolum* and *Umbilicaria phaea*. On the soil in crevices in the rock was *Dermatocarpon hepaticum*. On a large soil patch on a ledge near the top of the outcrop was *Cladonia subsquamosa*. A live oak yielded *Parmelia andreana*, *P. soredica*, *Caloplaca cerina* and *Rinodina roboris*. A final collection here was *Xanthoria ramulosa* on an *Aesculus*.

Mosses were equally interesting at Searsville Lake. Xerophytic mosses dominated the dry sandstones, with *Pseudobraunia californica* and several species of *Grimmia* forming continuous carpets covering several square yards of rock. Adventurous members of the party, braving the poison ivy which surrounded the base of the rocky hill, saw many of the species collected earlier on the foray, especially *Pterogonium gracile*, *Scleropodium obtusifolium*, *S. californicum*, *Bestia breweriana*, *Camptothecium nuttallii* and *Alsia californica*. Stopping at the dam on the way back to the cars, Dr. Persson pointed out an undescribed species of *Scleropodium* which was abundant on the wet, dripping face of the dam. Other species collected below the dam were *Barbula cylindrica*, *Merceya latifolia*, *Gymnostomum calcareum* (which seems to differ slightly from eastern material) and *Fissidens rufulus*.

REVIEWS

MÅRTENSSON, OLLE: "Bryophytes of the Torneträsk area, northern Swedish Lappland." I. Hepaticae. Kungl. Svenska Vetenskapsakad. Avhandl. Natursk. 12: 1-107. 1955. II. Musci. *Ibid.* 14: 1-321. 1956. III. General Part. Review of the Torneträsk area and comments on the lists of Hepaticae and musci. *Ibid.* 15: 1-94. 12 *textfig.*; 3 *maps*. 1956. Summary, 7 *pp.* Uppsala, 1956. (Inaugural Dissertation.)—This impressive series of publications is one of the most significant works on floristic bryology to appear during the past decade. Moreover, it covers an area of unusual bryogeographical and floristic interest. The reader is reminded at once of the equally comprehensive work by Arnell and Jensen, "Die Moose des Sarekgebietes." Mårtensson's magnificent contribution to bryology has a scope and a depth rarely equalled in this country, and an examination of this work will make American workers painfully aware of the paucity of publications of this magnitude, covering the more significant areas of the North American continent.

Northernmost Swedish Lappland is undoubtedly the most easily and most conveniently reached arctic region in the world, because one can ride on a comfortable train, without changing, all the way from Stockholm to Lake Torneträsk—and beyond, to the terminus of the line at Narvik. This remarkable situation exists because of the railroad built to haul copper ore from the Kiruna mines at the head of the Gulf of Bothnia to be loaded

aboard sea-going freighters at Narvik. As one who has spent several field seasons in the American Arctic, I was very favorably impressed by the easy access to the Torneträsk area and the comfortable hotels there, as well as by the availability of frequent local trains for travel to many excellent collecting areas. With the exception of regular tourist flights to Kotzebue and to Barrow by the Alaska Airlines, North America beyond the Arctic Circle can in general be reached only by chartered plane, by special arrangement with the military services, or on one of the infrequent flights scheduled by the Canadian Pacific Airlines.

Mårtensson demonstrates unusual insight by the clarity and penetration of his remarks concerning each of the species treated. From my own experience of working over a week with Mårtensson in the area he treats here, I can testify to the tireless enthusiasm and extraordinary field experience that this energetic and dedicated young bryologist has brought to bear on his study of the Torneträsk region. With the support and encouragement of such veteran Swedish bryologists as Dr. Herman Persson and Dr. Sigfrid Arnell, Mårtensson has become the leading younger specialist in his country.

Parts I and II, covering respectively the Hepaticae and Musci, consist of lucid and detailed remarks on every species included. The synonymy, as applicable to Swedish works, is given without comment. Under the heading "Taxonomy," the nomenclatural problems are treated carefully and thoughtfully. Not all American bryologists will agree with some of the names finally chosen, but at least they are provided with sufficient nomenclatural and taxonomic data to understand Mårtensson's reasons for the decisions he reached. Under the heading "Distribution," we find a brief statement of the altitudinal range of the species, followed by a careful analysis of its geographical range throughout the Scandinavian countries. Under the heading "Habitat," we find probably the most important and the most original data, and certainly those closest to the heart of the author, since they represent the results of many field seasons in the area under consideration. He began his studies in 1945, continued them in 1946, and worked in an even more concentrated fashion from 1951 through 1955. The habitat data, then, are the first-hand observations of the person most familiar with the region. Consequently, the analysis and definition of each habitat, as well as the notes on the association of species in each special habitat, are extremely enlightening and informative. From field work with Mårtensson and from careful reading of his monumental work, I have gained a better understanding of the habitat relations of our arctic American bryophytes. From seeing the very different habitat preferences in Lappland and in arctic America of species passing under the same name, I realize that several American species are probably endemics that need new and careful taxonomic study. Finally, under the heading "Material," the author cites the first or more important collections upon which his observations and conclusions are based.

In Part III, the "General part," Mårtensson supplies excellent background information on the Torneträsk area, including a "Survey of the natural features," covering such topics as situation, topology, geology and climate, as well as a "Survey of the vegetation in general," covering several categories of higher plant associations, as "The subalpine or birch forest belt," "The low-alpine belt," "The middle-alpine belt," "The high-alpine belt," and "The mires." The excellent photographs throughout give the reader an accurate impression and understanding of the magnificent terrain that would otherwise be impossible to gain. Following the background

chapters, Mårtensson contributes a chapter of unusual interest to bryologists, "General remarks on the bryophyte vegetation," which summarizes his extraordinary knowledge of the ecology and floristics of a region of unusual bryogeographical interest, and a chapter of explanatory notes concerning "The use of the list of Hepaticae and Musci." The list of collectors gives much important information on the date(s) of their field work and their itineraries that could not be found elsewhere. The extensive bibliography will be useful to everyone interested in boreal bryophytes. Finally, three well-annotated maps furnish in graphic form (1) the location of the Torneträsk area in relation to the Scandinavian countries, (2) the topography of Abisko National Park and its surroundings, and (3) the detailed location within the Torneträsk area of most of the geographical localities discussed in the text or from which collections have been cited.

The remarkable richness of the bryophyte flora in the Torneträsk area is illustrated by Mårtensson's estimate that about 130 species of hepatics and about 335 species of mosses occur in the Abisko National Park alone. The same species of bryophytes reach much higher latitudes in Lappland than in North America, as one can readily see by comparing Mårtensson's catalogues with Grout's *Moss Flora of North America*. One of the most remarkable illustrations of this point was my observation of *Diphyscium foliosum*—which in this country is not known to extend beyond the limits of the northern forest—on Mount Nuolja at an altitude of more than 3000 feet, and north of 68° North Latitude! Under such rigorous arctic-alpine conditions, only sterile plants occur. The vascular flora is likewise very rich, with nearly 500 species, and the forest extends considerably farther north than in North America.

Mårtensson describes no new species of varieties in this work, but he does propose the following new names and combinations: *Bryum cryophilum* O. Mårt. nom. nov. for *B. obtusifolium* Lindb.; *Pohlia filum* (Schimp. as *Bryum*) O. Mårt. comb. nov.; *Seligeria oelandica* var. *lapponica* (Nyman & Uggla as *S. lapponica*) O. Mårt. comb. nov.; *Tetrodontium ovatum* var. *brownianum* (Brid.) O. Mårt. comb. nov. and var. *repandum* (Funck) O. Mårt. comb. nov.; *Leiocolea heterocolpos* var. *arctica* (S. Arn.) S. Arn. & O. Mårt. comb. nov.; and *Sphenolobus minutus* var. *grandis* (Gottsche) S. Arn. & O. Mårt. comb. nov.

The Summary is brief and to the point. If reprinted in full here it would probably give a better idea of the nature of this monumental contribution to bryology than the present review.—WILLIAM C. STEERE.

Musci Japonici Exsiccati, Ser. 11 (*nos.* 501-550), edited by A. Noguchi & S. Hattori, The Hattori Botanical Laboratory, 3888 Obi, Nichinan, Miyazaki, Japan. December 1956. ($7.00.)—A complete list of the species represented in this series appeared in the December 1956 issue of the *Journal of the Hattori Botanical Laboratory*. Of the 50 specimens, 23 represent taxa not previously distributed by Noguchi and Hattori; 17 had been distributed once before and the remaining 10 twice before. Only 15 of the species are known to occur in all three boreal continents or both hemispheres (503, 506, 507, 508, 509, 510, 520, 521, 522, 523, 533, 534, 536, 545, 548); 27 of the species were not recorded from outside Asia by Brotherus (Nat. Pfl. 10, 11), and 10 of these (505, 512, 515, 518, 532, 537, 541, 542, 549, 550) were reported only from Japan. According to Japanese bryologists with whom I have corresponded, the Asiatic flora is so imperfectly known that it is useless to speculate on the seemingly restricted distributional patterns of

its species. However, of those listed by Brotherus, the following appear to be additions to the known Japanese flora since the appearance of *Die natürlichen Pflanzenfamilien*: 514, *Duthiella pellucens* Card. & Thér. 516, *Erythrodontium leptothallum* (C.M.) Nog. 525, *Haplocladium subulaceum* var. *amblystegioides* (Broth. & Par.) Thér. 527, *Hyophila stenophylla* Card. 538, *Pseudoleskeopsis orbiculata* Mitt. 539, *Rhacomitrium anomodontoides* Card. An additional four species were apparently not listed by Brotherus: 511, *Ctenidium homalophyllum* Broth. & Yas. 519, *Fissidens saxatilis* Tuz. & Nog. 524, *Habrodon leucotrichus* (Mitt.) Perss. 530, *Leucodon nipponicus* Nog. Some of the mosses mentioned above as circumboreal or bipolar in distribution may also have been additions to the known Japanese flora, but this could not be ascertained readily. Other specimens, interesting floristically, are *Aulacomnium heterostichum* (H.) BSG. and *Barbella pendula* (Sull.) Fl. (501, 502) which are known from Asia and North America but not from Europe, and *Thamnium alopecurum* (H.) BSG. (544), which is known from Asia and Europe but not from North America. Geographically speaking, 16 collections represented in series 11 originated in Kumamoto Prefecture (506, 507, 511, 513, 519, 520, 527, 528, 530, 535, 536, 538, 539, 543, 548, 550), where most of them were gathered by K. Mayebarae. Nine came from Nagano Pref. (504, 509, 510, 524, 532, 533, 534, 544, 549) and were collected by D. Shimizu, N. Takaki and Z. Iwatsuki. Nine others (502, 514, 518, 522, 525, 529, 540, 541, 542) are from Miyazaki Pref. and most of them were found by M. Mizutani and Z. Iwatsuki. The remaining 16 collections were contributed by 11 different persons and are from the following prefectures: Ehime, 547; Fukushima, 537; Fukuoka, 517; Hokkaido, 501; Kagoshima, 512, 515, 526, 546; Niigata, 508; Osaka, 516; Saitama, 503, 545; Toyama, 523; Tottori, 505, 521. No. 531 is from Tokyo.—Leo F. Koch.

RECENT LITERATURE ON MOSSES

Margaret Fulford[1]

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Bange, C. Le *Ptilidium crista-castrensis* existe-t-il dans la région parisienne? Bull. Soc. Bot. France *99*: 204-205. 1952.

Bopp, M. Die Beziehung zwischen Protonemaalter und Knospenbildung bei Laubmoosen. Rev. Bryol. et Lichén. *26*(3/4): 169-176. 3 *tab.* 1957 (1958).

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[1] Dept. of Biological Sciences, University of Cincinnati, Ohio.

gia Piedmont. Ecology 39(1): 16-23. 4 *fig.* 4 *tab.* 1958. [15 hepatics, 27 mosses]

Boros, Á. & L. Vajda. Der systematische Wert von *Tortula obtusifolia* Schleich. Rev. Bryol. et Lichén. 26 (3/4): 266. 1957 (1958).

Cookson, Isobel C. Difference in microscope composition of some samples from a bore at Coaum, South Australia. Austral. Jour. Bot. 1(3): 462-473. 1953. [New: *Sphagnites australis* (Cookson) n.c., with f. *parva* n. f. and f. *crossa* n. f.]

Crum, H. A. Review: Arthur L. Jewell, The Observer's Book of Mosses and Liverworts. 128 pp. *Pl.* 1-64 (*32 in color*). Frederick Warne & Co., Ltd. London & N. Y. 1955. The Bryologist 60(1): 47-48. 1957.

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Giesy, R. Studies on Ohio bryophytes. (Compilation of all species to date.) Ohio Jour. Sci. 57(5): 290-312. 1957.

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Györffy, I. Über E. Bauer—Musci cur. exs. No. 1185/b. Rev. Bryol. et Lichén. 26(3/4): 187-190. 1 *fig.* 1957 (1958).

Hisauchi, K. Non-vascular plants from Lake Nosori, Gunma Perfecture. Jour. Japan. Bot. 28(1): 20-30. 1953.

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Keever, Catherine. Establishment of *Grimmia laevigata* on bare granite. Ecology 38(3): 422-429. 1 *fig.* 3 *tab.* 1957.

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Lazarenko, A. S. Versuch einer Analyse der Laubmoosflora vom nordöstlichen Asien. Rev. Bryol. et Lichén. 26 (3/4): 146-157. 1957 (1958).

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Mizushima, U. The original source of *Andreaea petrophila*. Jour. Japan. Bot. 31(2): 64. 1956.

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———. Reports of some interesting mosses in Japan (4). *Ibid.* 28(2): 56-61. 7 *fig.* 1953. [New: *Physcomitrium trigoense* n. sp., *P. togamae* n. sp., *Okamuraea cristata* v. *gemmata* n. v., *Warburgiella sikokiana* n. sp., *Bryhnia delicatula* n. sp., *Entodon rubrissimus* n. sp., *E. subdiversinervis* n. sp., *Tortula tutegae* n. sp.]

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RECENT LITERATURE ON LICHENS—26[1]

WILLIAM L. CULBERSON[2]

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AHMADJIAN, V. The fruticose and foliose lichens of Worcester County, Massachusetts. Rhodora *60*(711): 74-86. 1958. [Many spp. Keys.]

ASAHINA, Y. Lichenologische Notizen (§ 130). Jour. Jap. Bot. *32*(9): 257-260. *3 fig.* 1957. [*Cladonia boryi* Tuck. and *C. nipponica* Asahina.]

———. Lichenologische Notizen (§ 131-134). *Ibid.* *32* (12): 359-362. *2 fig.* (1957) 1958. [*Bacomyces aggregatus* Asahina, *Lecidea handelii* Zahlbr. New: *L.* (Psora) *pseudohandelii* n. sp., *Cladonia shikokiana* n. sp.]

AUBERT DE LA RÜE, E., F. BOURLIÈRE & J.-P. HARROY. The Tropics. 208 pp. *illus.* Alfred A. Knopf. New York. 1957. [Lichens: pp. 30, 45, 105, 111-112, 117.]

BARCHALOV, S. O. Nonnulli Lichenes pro Caucaso novi ex Azerbaidzhan. [Bot. Materialy] Notulae System. e Sect. Cryptog. Inst. Bot. nomine V. L. Komarovii Acad. Sci. URSS *8*: 1-5. 1952. [15 spp. In Russian.]

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BOLD, H. C. Morphology of Plants. xxiii + 669. *illus.* Harper & Brothers, Publishers. New York. 1957. [Lichens, pp. 223-230.]

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[1] Names of new taxa from the Americas are marked with an asterisk (*).

[2] Dept. of Botany, Duke University, Durham, N. C.

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———. Studies on the chemistry and distribution of North American lichens (10-13). *Ibid.* 61(1): 81-85. 8 *fig.* 1958. [*Lobaria linita* (Ach.) Rabh., *L. oregana* (Tuck.) Müll. Arg., *Parmelia finkii* Zahlbr., *P. aurulenta* Tuck.]

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LETROUIT-GALINOU, M[ARIE]-A[GNÈS]. Revision monographique du genre *Laurera* (Lichens, Trypéthéliacées). Rev. Bryol. et Lichén. 26(3-4): 207-264. 10 *pl.* (1957) 1958. [21 spp. Key. New: *L. megasperma* f. *immersa* n. f., *L. pyriformis* (Dodge) n. c., *L. sphaerica* (Dodge) n. c.]

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NEWS AND NOTES

THE NINTH INTERNATIONAL BOTANICAL CONGRESS: Lichenology will be included in the section on mycology. Bryology has been constituted as a section of the congress. The official call for papers and final plans for various botanical excursions will be included in the second congress circular to be distributed in October. More than 100 persons have indicated that they will (or will probably) attend the bryological sessions and foray, and about 70 titles have been submitted tentatively. MARGARET FULFORD and LEWIS ANDERSON have joined JAMES KUCYNIAK and HOWARD CRUM (chairman) on the planning committee.

RONALD MCGREGOR has received a grant from the National Science Foundation for extensive field work in Mexico during 1959. HARVEY ALFRED MILLER has been awarded a Guggenheim Fellowship for completing an illustrated manual of Hawaiian Hepaticae.

WINONA WELCH visited Jamaica during Easter vacation. She collected about 340 specimens of bryophytes in the Blue Mts. (at Hardwar Falls and Gap) and on John Crow Mt. (near Bath Fountain Inn), Long Mt. and Mt. Horeb (at Fairy Glade). (Incidentally keys to the species of Jamaican mosses by Howard Crum and E. B. Bartram will soon be available in a publication by the Science Museum of the Institute of Jamaica.)

A limited number of reprints of Schuster's "Annotated keys to the orders, families and genera of Hepaticae of America north of Mexico" are available from DR. LEWIS E. ANDERSON, Duke University, Durham, N. C., at a cost of $1.50. Proceeds from the sale will help cover the considerable difference in publication cost of THE BRYOLOGIST and the income from subscriptions. This paper is extremely useful not only in identification but also as a guide

to the extensive and scattered literature of the past 20 years.

A manual of the mosses of Puerto Rico by HOWARD CRUM and WILLIAM C. STEERE was published on December 13, 1957 by the N. Y. Academy of Sciences. In January (not December as printed on the cover) A. LEROY ANDREWS published an excellent series of keys to the mosses and liverworts of the Upper Cayuga Lake Basin, New York, as Cornell University Agricultural Experiment Station Memoir 352. These keys should be very useful in most parts of eastern North America, and the simplified key to the *Sphagna* will be especially welcomed.

The index to the first 60 volumes of THE BRYOLOGIST is now complete and will be printed in the fall of this year.

DR. SUZANNE JOVET-AST was recently promoted to assistant director of the Laboratoire de Cryptogamie at the Muséum National d'Histoire naturelle de Paris.

The annual meeting of the American Bryological Society will be held on Aug. 25 at Indiana University in Bloomington and will be preceded by a foray beginning at Greencastle on Aug. 23 and visiting Fern Cliffs, Fallen Rock, Sword Moss Gorge, Camp Friend, Hoosier Highlands and several other botanically interesting places before moving on to Bloomington late Aug. 24. Rare mosses to be seen on the foray include *Bryoxiphium norvegicum* and *Hookeria acutifolia*.

DR. WINONA WELCH, who is conducting the foray, plans a social hour at 108 Harrison Hall, DePauw University, at 8 P.M. on Aug. 22 and also on the next evening when slides of trips, botanists, etc. will be shown. A few slides from each member are solicited.

Those who wish also to see Indiana's famed Turkey Run State Park should notify Dr. Welch who plans a pre-foray visit on Aug. 22.

The ninth (and final) fascicle of Müller's *Die Lebermoose Europas* (edition 3) was received for review early in May (but presumably published in 1957).

JOHN THOMPSON, accompanied by SAM SHUSHAN, will leave for Barrow, Alaska, early in July and will return home during August. A. J. SHARP will also visit Alaska during the summer.

WILLIAM WEBER, who has spent the past year at the Naturhistoriska Riksmuseet, Stockholm, writes: "Almost all of my time has been spent with our microlichens (*Lecanora, Lecidea, Rinodina, Acarospora*, etc.). I have seen all the type material of species pertinent to a review of our American *Acarosporae* and will write this up next fall. I've succeeded in naming most of our collections of the above genera from western North America. In doing so I've been fortunate to be able to check most of Bouly de Lesdain's and Magnusson's species based on Brouard's New Mexican collections. (Fragments of most of these are in Magnusson's herbarium.)

Of course, we have turned up, as anticipated, a rich disjunct boreal and arctic flora in the southern Rocky Mountains, but the biggest news is the very solid connection we have found between the southwest American desert flora and those of the other major desert areas of the Northern Hemisphere. We not only have several species of *Acarospora* and *Lecanora* in common with the North African, Spanish, Italian, Turkestan and Russian dry lands, but we have so far 50 species listed

by Magnusson in his report on the lichens of central Asia collected by Sven Hedin. Fourteen represent the only collections since the type. For example, we have the following unique central Asiatic things: *Catillaria sculpturata, C. kansuensis, Dermatocarpon inaequale, Endocarpon mongolicum, Lecanora maculata, L. percrenata, L. regalis, L. determinata, L. semipallida, L. alaicusis, L. pavimentans, L. subsmaragdula* and *Caloplaca paulseni;* all except *L. alaicusis* (Wainio) and *Caloplaca paulseni* (Wainio) were first described by Magnusson in 1940. Evidently the lichen flora is a very conservative one and relict one of extremely long standing, probably to a greater degree even than the moss flora which shows some similar distribution patterns.

I expect to finish my indoor work this month [April] and to spend the summer in the field in Scandinavia and wind up the work with two weeks' collecting in the Alps."

Henry Imshaug plans to collect lichens in Haiti and the Dominican Republic this summer. (Earlier plans to visit Cuba this year were abandoned because of the current political unrest there.)

Kjeld Holmen will spend the summer in Greenland, on the east coast between 70 and 72° N. Lat., collecting mosses and preparing for a 4-yr. excursion to the area in 1959-62.

Mosses of Indiana, by Winona Welch, was recently listed by the Conference of Indiana Writers as one of the best books by an Indiana author during the past year.

Index to Plant Chromosome Numbers. The need for up-to-date coverage of the literature dealing with plant chromosome numbers has led to an undertaking designed to compile and publish in annual installments a chromosome index for the entire plant kingdom. This is being done by a group of botanists who are reviewing some 200 journals and are listing all original chromosome counts occurring therein, except those resulting from endopolyploidy or deviating because of experimental treatment. The Index, compiled from the journals of a single year, will be published annually within the shortest possible time after the last issue of each journal is available. In addition, there is planned a supplement containing counts published in previous years, but hitherto not indexed. Each issue of the Index will contain a complete bibliography for the counts included in that number.

The first issue, in part supported by a grant from the University Research Council of the University of North Carolina, was ready for distribution in May. It covered the 1956 journals, from which over 2000 listings were taken. It was produced by offset process on 8½ × 11 inch paper, punched for loose-leaf binders. The price is $1.00. Orders (except from libraries and institutions) *must* be accompanied by payment and may be sent to C. Ritchie Bell, Dept. of Botany, University of North Carolina, Chapel Hill, N. C. Further information can be obtained from Marion S. Cave, Dept. of Botany, University of California, Berkeley 4, Calif.

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THE HEPATIC EXCHANGE

Beginning January 1, 1939, this Exchange has been operated under the same rules as The Moss Exchange. Privileges are available only to members of the American Bryological Society who have paid annual dues of 25c to Dr. Leo F. Koch, Herbarium, 350 Natural Science Bldg., University of Illinois, Urbana, Ill. Only fully determined specimens in packets with complete data will be accepted. It is suggested that there be at least five packets of each species with an extra which will be forwarded to the Curator of Hepatics for the American Bryological Society Hepatic Herbarium. All material for determination should be sent to the Curator of Hepatics, Dr. Margaret Fulford, Department of Botany, University of Cincinnati, Cincinnati, Ohio.

THE MOSS EXCHANGE

As announced in The Bryologist **38**: 100, Sept.-Oct., 1935, there is now an exchange for mosses. This exchange is available to members of the American Bryological Society upon payment of annual dues of 25c to Dr. E. H. Ketchledge, Dept of Forest Botany, State College of Forestry, Syracuse 10, New York. Only fully identified specimens in packets with complete data on them should be sent in. It is suggested that there be five or more packets of each species.

These two exchanges offer an excellent opportunity for A.B.S. members to build up their own herbaria of choice, well-labelled specimens.